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Year 3 (2002) Annual Reports
For the Kingman Monitoring Project

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Third Year Annual Report (2002) for the Kingman Marsh Vegetation Monitoring Project

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Third Year Annual Report (2002) for the Kingman Marsh Vegetation Monitoring Project

Introduction

Vegetative cover at Kingman Marsh continued to decline during 2002 (Year 3 of the five-year vegetation monitoring project). The continued decline in vegetative cover is attributed to grazing pressure by the resident Canada geese (RCG) often coupled with reduced elevations as a consequence of consolidation and erosion.

Based on weekly point count observations, Mary Paul (USGS/Patuxent Wildlife Research Center) has established that the RCG populations remained similar or increased slightly for each of the four seasons from 2001 to 2002 at Kingman. Within the confines of the viewsheds from her observation points she noted a little less than 250 RCG per visit at Kingman but only 50 at Kenilworth, data that reinforces the notion of a substantially elevated population at Kingman and the corresponding reduction in vegetative cover there. The extended grazing of marsh vegetation by the geese has seriously derailed the expected establishment and maturation of the reconstructed wetland.

Given the demise of the marsh, which was exaggerated at the lower elevations, the US Army Corps of Engineers (COE) replanted perhaps a third of the eat-out areas with the less palatable soft-stem bulrush (*Schoenoplectus tabernaemontani)* and green arrow arum (*Peltandra virginica).* These plantings were protected by a series of newly erected fenced cells about 15 x 25 feet in size, and established successfully. The difficult winter of 2002-2003 caused significant damage to this goose fencing, and will require repair to continue to protect the new vegetation. As of the time of this writing (Spring 2003) the COE has installed a heavy-duty perimeter fence around Kingman Area 2 and portions of Kingman Area1. The necessity of producing a functional Resident Canada Goose Management Plan (GMP) for the Anacostia is apparent and has been initiated by the District of Columbia (DC) in conjunction with the National Park Service (NPS).

The Year 3 Report documents vegetation data that were collected at Kingman Marsh and the comparison wetlands (Kenilworth, Dueling and Patuxent) during 2002.

1. Total Vegetative Cover

Vegetative cover remained in a state of decline during 2002 at the Kingman marshes. Total vegetative cover over time for Kingman and the comparison wetland areas is shown in Figure 1a; results of the repeated measures analysis of variance for cover are shown in Table 1. The repeated measures analysis indicates that patterns of total vegetative cover over time are very different among the study wetlands (Area x Month(Year) term in Table 1). Results of the Tukey tests show that during the 2002 sampling events, total vegetative cover at Kingman Area

1 was significantly lower than that found at the reference marsh on the Patuxent (Figure 1a). Other within-sampling event comparisons were of mixed significance. However, there is evident divergence of the Kingman plots from the comparison wetland plots after September 2000 and through 2002. This corresponds to removal of protective fencing, resultant access by the geese, increased grazing pressure and hesitant at best vegetative recovery particularly in the lower areas.

In terms of year-to-year differences within Kingman, total vegetative cover means for September 2002 represented significant declines with respect to September 2000, for both Kingman Areas 1 and 2 (Fig. 1b). At Kingman Area 1 means declined from 88 ± 11% (mean ± standard error) to 43 ± 8%; at Kingman Area 2 means declined from 117 ± 6% to 43 ± 8%. It should be noted that the COE did replant 6.5 acres of wetland at Kingman in 2002 mostly with the less palatable *S. tabernaemontani* and *P. virginica*, but also some *Nuphar lutea* (yellow pond-lily) and *Sagittaria latifolia* (broadleaf arrowhead). Unfortunately much of this planting did not coincide with the pre-existing transect lines and is not reflected in this data set.

Total vegetative cover means in the unplanted portions of Kingman Area 1 (as represented by 2 transects) were consistently greater than in the planted portions of Kingman Area 1 (as represented by 12 transects) (Figure 1b), although none of these within-sampling-event differences were statistically significant. Unlike the planted portion of Area 1, the unplanted portion did not show a statistically significant decline in total vegetative cover between 2000 and 2002. This was due in part to increases in cover by two species, *Salix nigra* (black willow) and the invasive *Lythrum salicaria* (purple loosestrife). To the extent that simple cover is of value, this result suggests reduced need for planting, particularly where elevations are sufficient to achieve cover.

None of the year-to-year differences observed at the comparison wetlands (Figure 1a) were statistically significant. The unreconstructed reference wetlands (Dueling and Patuxent) and the previously reconstructed Kenilworth Mass Fill 2 remained at 100% cover or more. Kenilworth Mass Fill 1, which had experienced a significant decline in total vegetative cover from July to September 2001 ($p = 0.02$) due to Rodeo treatment of *Phragmites*, started to rebound, with total vegetative cover increasing from 36 ± 15% cover in September 2001 to 85 ± 7 % cover in September 2002. But once again, it needs to be emphasized that there was serious decline in the vegetation at the Kingman areas after September 2000, which did not occur in the comparison marshes except for the Rodeo-treated Kenilworth site.

2. Total Vegetative Cover vs. Elevation

Total vegetative cover at Kingman in 2002 remained positively correlated with elevation (Figure 2), suggesting that the combination of goose predation and low elevation continues to have a major negative impact on vegetation at Kingman. One could draw the conclusion if total plant cover were the goal, higher elevations should be as conducive in the presence of a healthy seed bank as plantings. It has, however, been recognized that the higher elevations seem to promote *Phragmites* and *Lythrum* establishment (unwanted invasive species) so target elevations were lowered for the Kingman Marsh reconstruction. However, spot elevation checks based on the GOLF benchmark (for Kingman Area 1) being 6.65' NGVD '29 do show a

number of marsh locations below the plan target of 1.5'. This may result in less cover than anticipated, especially where the plantings fare poorly and resultant cover would depend more on seed bank that cannot respond by germination under the longer periods of inundation.

SET (Surface Elevation Table) readings in 2003 should begin to help portray the pattern of sediment processes at this urban reconstructed freshwater tidal marsh. Sediments left exposed from goose grazing are readily erodible and less prone to collect sediment. Hopefully also, the array of exclosures installed for wild rice establishment by the Anacostia Watershed Society as well as the experimental exclosures (established by Peter May and Dick Hammerschlag in 2001) will shed more light on the innate marsh potential at various elevations when protected from geese and other wildlife. It remains to be seen whether the combination of low elevations coupled with goose grazing may provide a stress factor that is hard to overcome (aside from plantings), even with reduction of or protection from the resident Canada goose population.

3. Cover by Species

Cover contributed by individual species (2000-2002) is illustrated for each area in Figure 3. Each graph shows annual means (average of July and September) for dominant species (those with cover means of at least 5% during at least one sampling event) and potentially invasive species of special concern (*Lythrum salicaria*, purple loosestrife; *Phragmites australis*, common reed; and *Typha* spp, cattail). The Kingman graphs also include planted species.

As seen in Figure 3a, the greatest 'contributor' in the planted portion of Kingman Area 1 in 2002 was the 'No Cover' category at 64 ± 6%. Only three species met the criteria for dominants in 2002: *Ludwigia palustris* (marsh seedbox, a pioneer ground cover), *Peltandra virginica*, and *L. salicaria*. Of these three species, only *P. virginica* was planted. The planted species, *Pontedaria cordata* (pickerelweed), present in 2000 as a dominant, remained virtually absent in 2002. Three other planted species, S. *tabernaemontani*, *Sagittaria latifolia* (broadleaf arrowhead), and *Schoenoplectus pungens* (common three-square), present at sub-dominant levels in 2000, were virtually absent or at reduced levels in 2002. *Juncus effusus* (common rush), also planted in 2000, appears to have held its own in 2002. All three species of special concern (*Phragmites*, loosestrife and cattail) were present and increasing in 2002, though *L. salicaria* was the only one present as a dominant.

The greatest contributor at Kingman Area 2 in 2002 was again the 'No Cover' category, at 69 ± 12% (Figure 3b). Only two species met the criteria for dominants at Kingman Area 2 in 2002: the planted species, *S. tabernaemontani*, and the potentially invasive *Typha* spp. As in 2001, goose predilection for *P. cordata* and *S. latifolia* has seen their presence reduced to occasional occurrences essentially as escapes tucked in amongst other vegetation.

These results suggest that planting does directly introduce desirable planted species. How well they endure is another question as goose preferred species like *P. cordata* and *S. latifolia* were decimated but still remain in spots and could recover if protected or the goose pressure is removed.

The small area of the marsh left unplanted has not yet developed populations (producing more than 5% cover) of any of the planted species (Figure 3c) whether from the old seed bank or spread from the planted areas nearby. Four volunteer species were present as dominants in the unplanted area during 2002: *Ludwigia palustris* and *L. peploides* (low pioneer ground covers), *Salix nigra*, and *Lythrum salicaria*. This, for the moment, suggests that if you don't plant you will get cover from seed bank species (mostly water-borne seed), but these may not be the ones you want most. Thus some planting does jump start species of interest but it may not be necessary to plant the whole area to get a desirable marsh. Ultimately, species are sorted and filtered according to what the site conditions will best support as associated with available germplasm - or simple survival of the fittest.

Cover at the comparison wetlands for the same time periods is much more robust than at Kingman. At Kenilworth Mass Fill 1 (Figure 3d), the 'No Cover' category averaged only 7 ± 3% in 2002. Three taxa met the criteria for dominants: *Leersia oryzoides* (rice cutgrass), *Typha* spp, and *P. virginica*. The invasive species *P. australis* dropped below the dominant threshold used due to spraying in 2001.

Six plant taxa met the criteria for dominants at Kenilworth Mass Fill 2 in 2002 (Figure 3e): *P. australis*, *L. oryzoides*, *Schoenoplectus fluviatilis* (river bulrush), *Typha* spp, *P. virginica*, and *Zizania aquatica* (annual wildrice, which once dominated the historical marshes along the Anacostia).

Kenilworth is but a quarter of a mile away from Kingman but benefits from a much-reduced presence of geese and higher sediment elevations than Kingman. It seems that Kenilworth Marsh in most cases is able to outgrow the grazing pressure exerted by the waterfowl that frequent the site. There seems to be a Catch 22 with Kingman and that is the lower elevations there reduce pressure from unwanted invasive species but that same thwarting of growth in the presence of the geese slows down the capacity of the marsh to recover. The potential for growth at Kingman is revealed by the response where fencing provides protection. However, even with fencing, vegetative growth and seedling establishment is visibly reduced at sediment elevations below 1.5' NGVD '29. From this one might surmise that optimum elevations in the Anacostia to promote wetland growth but retard invasives may be between 1.5' and 1.9' NGVD '29.

Dueling Creek, which lies in the Anacostia just half a mile upstream from Kenilworth, and resides along a relatively high bench (judging by short periods of inundation) seems to have a reasonably good vegetative composition (Figure 3f). Four species met the criteria for dominants in 2002: *Leersia oryzoides*, *Impatiens capensis* (jewelweed), *Polygonum arifolium* (halberdleaf tearthumb), and *Polygonum sagitatum* (arrowleaf tearthumb). *Phragmites*, which is such an invasive problem at Kenilworth, is conspicuous by its absence in the transects at Dueling Creek.

The model provided by Patuxent (Figure 3g) is a good one since it is primarily a low marsh that does well without excessive grazing pressure. Nine species met the dominant criteria: three polygonums, *I. capensis*, *Nuphar lutea*, *Hydrilla verticillata (an invasive, non-native, submersed aquatic weed)*, *Peltandra virginica*, and *Pilea pumila* (clearweed). Patuxent lacks

the presence of the invasive species (*Phragmites australis* and *Lythrum salicaria*) found in the Anacostia. While we don't have actual elevations for Patuxent, the correspondence of duration of inundation from the hydrologger data between Patuxent and Kingman (particularly Kingman Area 2) supports the hydrologic model. It is also true that the Kingman/Anacostia areas were once rich in emergent wetland cover and thus every effort must be made to reach that target.

4. Sørenson's Similarity Index

Similarity of species composition at the study wetlands was determined using Sørenson's similarity index (Table 2). Sørenson's similarity index compares presence/absence data from two areas to produce an index that varies from 0 if the areas have no species in common, to 1 if both areas have all species in common. Results indicate the greatest similarities in species composition lie between Kenilworth Mass Fill 1 and Kingman Area 1 (0.61), and Kingman Areas 1 and 2 (0.57). The lowest similarities are indicated between Patuxent and Kingman Areas 1 (0.41) and 2 (0.38). However, based on hydrology one would ultimately expect Kingman Area 2 to be similar to Patuxent. The current failure of Kingman Area 2 to compare closely may be attributed to the goose grazing effects and that there hasn't been sufficient time for full adjustment since reconstruction.

5. Species Richness

Species richness, or the comprehensive number of species found in all of the transects in each area, has declined dramatically over time at Kingman Areas 1 and 2, but remained stable at the comparison wetlands (Figure 4a1 and Table 3). A full list of species identified in transects at Kingman during 2002 is presented in Table 4.

Species density, or the number of species per 5-m^2 sector, has declined significantly over time in both the planted and unplanted portions of Kingman Area 1, as well as Kingman Area 2 (Figure 4a), presumably as a result of the goose grazing and low elevations. Within-sampling event differences between Kingman Area 1 planted and unplanted and Kingman Area 2 were generally not statistically significant. Nevertheless, there is an apparent difference between the unreconstructed reference sites of Patuxent, as well as Dueling and the Kingman areas. There's even a visual difference between the unreconstructed sites and Kenilworth.

When species density data from all areas and all sampling events were compared using repeated measures analysis of variance, the results indicate that species densities at the different areas are behaving differently over time (Area x Month (Year) in Table 1). Statistical differences within sampling events were limited to the Kingman Area 1 and Patuxent comparisons for May and July of 2002 (Figure 4b). In July 2002 species density at Patuxent averaged 10 ± 2 compared to 3 ± 0.8 at Kingman Area 1. None of the year-to-year differences at the comparison wetlands were statistically significant (Figure 4c). As with the differences between areas within sampling events, there is evident visual stratification in the graph among the unreconstructed reference sites, the early reconstructed Kenilworth sites (1993) and the recent (2000) reconstructed Kingman sites when looking at differences between years within areas. Two separate trends may be observed. The first is that there is a sharp seasonal decline in May simply relating that fewer species have emerged in May. Then, looking beyond this seasonal response, one can observe the overall decline during the summer months from

September 2000 through September 2002 which has been attributed to the goose grazing effects and where pertinent low sediment elevations.

6. Diversity

The pattern of diversity over time paralleled that of species richness and showed a significant decrease at the Kingman marshes from 2000 (Figure 5a), again attributable to goose grazing. The decline in diversity at the two unplanted transects was not significant. It should be noted that the Shannon Diversity Index was calculated only on the basis of sectors supporting vegetation since unvegetated sectors would count as zero and confound the calculation process. However, in terms of appreciating the distribution of plants at Kingman it should be noted that 217 out of the 973 sector records (2000 through 2002) possessed no vegetation (roughly one-quarter!!!). None of the other marshes had any sector with no vegetation. This, too, demonstrates the extreme effect of the goose grazing and elevation problem at Kingman.

When diversity values from all of the study areas and sampling events are analyzed, results of the repeated measures analysis of variance indicate that diversity is behaving differently over time at the different study wetlands (Area x Month(Year) term in Table 1). Diversity tends to be greater at Patuxent and Dueling Creek than at the constructed wetlands, although these differences were statistically significant during only three of the eight sampling events (Figure 5b). Diversity also tends to be more stable at the non-reconstructed wetlands and at Kenilworth, an older constructed wetland (Figure 5c). The fact that the comparison wetlands did not show the same decline in diversity as that exhibited by Kingman during the same timeframe indicates that the decline was not related to factors such as weather.

7. Annuals

Repeated measures analysis of variance indicates that there are significant differences among the study wetlands in the way that the proportion of cover contributed by annuals is behaving over time [Area x Month(Year) term in Table 1]. Proportion of cover contributed by annuals is significantly greater at Patuxent than at Kingman Area 1 (Figure 6a). For example, proportion of cover contributed by annuals during September 2002 was 65 ± 13% at Patuxent, compared to 5 ± 2% at Kingman Area 1. Data from the three most recent sampling events also show a clear tendency for proportion of cover contributed by annuals at Patuxent to exceed the proportions at Kingman Area 2, Kenilworth Mass Fill 1 and Kenilworth Mass Fill 2.

The proportional cover by annuals is a bit surprising. A reconstructed marsh might be prone to strong contribution by annuals at first as the seed process for spread should be quicker (and more numerous) than perennial extension (although perennials can also yield a vigorous seed set). Such is not what we are seeing. However, some studies have found a high level of annuals in the seed bank but less in the vegetative cover for recently reconstructed freshwater tidal marshes (Baldwin and Derico, 1999). If we use annual species as a marker for success of wetland establishment, the species composition at Kingman needs to be comprised of more annuals. This is perhaps reflected when one looks at the number of species identified as annuals (Table 5) with the greatest number and percent occurring at Kingman Area 1 as well as Kenilworth MF 1. It is also true that these two areas have at least some locations with higher

elevations, which seem to support seedling establishment and thus might favor diversity of annuals.

Proportion of cover contributed by annuals has declined significantly over time at Kingman Areas 1 and 2 (Figure 6b), in contrast with the proportions at the comparison wetlands, where none of the year-to-year differences were statistically significant.

8. Exotics

Repeated measures analysis of variance indicates that the differences in proportion of cover contributed by exotics over time at the study wetlands are not statistically significant (Area x Month(Year) term in Table 1). Similarly, results of the Tukey tests indicated no significant differences either between areas within sampling events, or between years within areas (Figure 7).

Proportion of cover contributed by exotics in September 2002 was 17 ± 4% for Kingman Area 1 and 14 ± 14% for Kingman Area 2. Numbers at Dueling Creek and Patuxent were quite similar. The decline in exotic plant cover at Kenilworth Mass Fill 1 (significant biologically, though not statistically) is in response to the Phragmites control program organized by the National Park Service and implemented in 2001. The increase in proportion of cover contributed by exotics seen at Kenilworth Mass Fill 2 during the last year and a half is likely attributable to *Phragmites* expansion prior to treatment. This elevated cover by invasive exotics at Kenilworth displays the disproportional influence that can be exerted by unchecked invasive species.

When one examines the proportion of taxa identified as exotics in 2002 (Table 6), the low percent at the stable Patuxent wetland is striking compared to the urban wetlands of the Anacostia. However, the number of exotic species is really not that high in any of the wetlands. Hopefully this pattern will sustain.

Observations at Kingman Area 1 revealed an increase in *Phragmites* at the higher elevations and may portend a problem there if not dealt with soon.

9. Biomass

The repeated measures analysis of variance indicates that, speaking statistically, the study areas are behaving the same over time in terms of biomass of living plant material (Area x Year term in Table 2). Tukey results show a general lack of statistical significance in differences between areas within sampling event, or between years within areas (Figure 8). The effect of Rodeo treatment of Phragmites in the Kenilworth transects is apparent in the lower biomass levels there for 2002, but it should be noted that these decreases were not significant from the statistical standpoint.

10. Elevations and Surface ElevationTables (SETs)

In 2001, Kelly Phyillaier Neff surveyed elevations of transect sectors relative to the calibration point on the closest hydrologger. From this she was able to calculate duration of inundation for each sector from the tidal data collected by the hydrologgers. Independently, Dick Hammerschlag has been assembling a series of actual elevations, which depend on known elevations from local benchmarks. To date, there is an ongoing effort by COE to verify the elevations of their benchmarks based on NGVD '29 tidal epochs. Thus, rather than provide unverified elevations at this time, we will hold off and provide them in the next report. These elevations will be useful to determine the actual elevations of various portions of the marsh and draw correlations with goose grazing impacts and seedling establishment. The elevations are also important to several tasks in Kevin Brittingham's benthic study as well as the SET work.

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In August 2002, with the assistance of Jim Lynch (USGS Patuxent Wildlife Research Center), we installed a series of 10 SETs - five at Kingman Area 1 and five at Kenilworth. The SETs (Cahoon et al. 2002) are used to study sediment processes and will allow us to track rates of sediment deposition, consolidation and erosion over time. We installed the SETs at a series of elevations that should be close to 1.7', 2.1' and 2.5' NGVD '29. At Kingman one pair at one location was placed at 1.7' and 2.1' while a set of three were placed at a separate location at all 3 elevations. A similar placement procedure was also used for the 5 SETs at Kenilworth. In October 2002, we obtained our first set of readings from the 10 SETs. This data will have relevance to readings taken in 2003 and thus will be presented in the next Annual Report.

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Tables

Table 1. Analysis of variance table of vegetative parameters for all areas for 2000 through 2002. Significance noted as * (<0.05); ** (<0.01); *** (<0.001); **** (<0.0001). Expression written: Fvalue (Numerator df, Denominator df).

	Area	Year	Area x Year	Month(Year)	Area x Month(Year)
Cover	9.78****(5,27.69)	15.11****(2,62.64)	4.92****(10,61.73)	16.41****(5,62.21)	4.13****(25,70.98)
Species Density	2.03(5,27.06)	77.73****(2,94.80)	40.33****(10,63.24)	3.09*(5,93.29)	3.58****(25,73.00)
Diversity	3.12*(5,27.42)	54.83****(2,59.22)	20.67****(10,61.23)	3.87**(5,58.43)	2.93***(25,70.28)
Annuals	11.39****(5,27.79)	22.58****(2,31.51)	10.07****(10,41.24)	5.50**(3,31.12)	2.01*(15,44.08)
Exotics	0.86(5,30.07)	3.90*(2,38.80)	2.48*(10,36.53)	0.96(3,38.70)	0.73(15,38.78)
Biomass (Living)	4.26**(5,22.16)	1.49(2,19.88)	1.90(10,28.11)	NA	NA

Table 2. Sørenson's Similarity Matrix for vegetation in 2002.

	Kingman		Kenilworth		Dueling	
	Area 1	Area 2	MF1	MF2	Creek	Patuxent
Kingman Area 1	1	0.57	0.61	0.49	0.48	0.41
Kingman Area 2		1	0.49	0.51	0.44	0.38
Kenilworth MF1			1	0.53	0.54	0.45
Kenilworth MF2				1	0.48	0.42
Dueling Creek					1	0.54
Patuxent						1

Table 3. Species richness over time.

		Number of Plant Species Identified in Area Transects		
Area	Number of Transects	2000	2001	2002
Kingman Area 1	**15**	88	57	42
Kingman Area 2	**3**	51	20	23
Kenilworth MF1	**3**	25	24	40
Kenilworth MF2	**4**	28	30	25
Dueling Creek	**3**	29	29	30
Patuxent	**6**	40	39	40

Table 4. Species identified in the transects at Kingman during 2002.

Kingman Area 1			
Scientific Name	**Acronym**	**Scientific Name**	**Acronym**
Amaranthus cannabinus	AMACAN	*Pontedaria cordata*	PONCOR
Bidens frondosa	BIDFRO	*Populus deltoides*	POPDEL
B. laevis	BIDLAE	*Sagittaria latifolia*	SAGLAT
Boehmeria cylindrica	BOECYL	*Salix nigra*	SALNIG
Carex lurida	CARLUR	*Schoenoplectus tabernaemontani*	SCHTAB
Cephalanthus occidentalis	CEPOCC	*Scirpus cyperinus*	SCICYP
Cyperus erythrorhizos	CYPERY	*Scirpus polyphyllus*	SCIPOL
C. flavescens	CYPFLA	*Typha* spp.	TYPSPP
Echinochloa sp.	ECHSP	*Zizania aquatica*	ZIZAQU
Eclipta prostrata	ECLPRO		
Eleocharis obtusa	ELEOBT		
Heteranthera reniformis	HETREN		
Hibiscus moscheutos	HIBMOS		
Hypericum mutilum	HYPMUT		
Impatiens capensis	IMPCAP		
Juncus effusus	JUNEFF		
Leersia oryzoides	LEEORY		
Lindernia dubia	LINDUB		
Ludwigia palustris	LUDPAL		
L. peploides	LUDPEP		
Lycopus americanus	LYCAME		
L. virginicus	LYCVIR		
Lythrum salicaria	LYTSAL		
Mikania scandens	MIKSCA		
Mimulus ringens	MIMRIN		
Murdannia keisak	MURKEI		
Peltandra virginica	PELVIR		
Penthorum sedoides	PENSED		
Phragmites australis	PHRAUS		
Polygonum hydropiper	POLHYD1		
P. hydropiperoides	POLHYD2		
P. lapathifolium	POLLAP		
P. persicaria	POLPER		

Table 4 (Cont.). Species identified in the transects at Kingman during 2002.

Kingman Area 2	
Scientific Name	**Acronym**
Bidens sp.	BIDSP
Boehmeria cylindrica	BOECYL
Cyperus erythrorhizos	CYPERY
Echinochloa sp.	ECHSP
Eclipta prostrata	ECLPRO
Juncus effusus	JUNEFF
Leersia oryzoides	LEEORY
Ludwigia paulstris	LUDPAL
Ludwigia peploides	LUDPEP
Lycopus americanus	LYCAME
Lycopus virginicus	LYCVIR
Lythrum salicaria	LYTSAL
Nuphar lutea	NUPLUT
Panicum dichotomiflorum	PANDIC
Peltandra virginica	PELVIR
Phragmites australis	PHRAUS
Polygonum hydropiperoides	POLHYD1
Polygonum lapathifolium	POLLAP
Pontedaria cordata	PONCOR
Sagittaria latifolia	SAGLAT
Salix nigra	SALNIG
Schoenoplectus tabernaemontani	SCHTAB
Typha spp.	TYPSPP

Table 5. Proportion of taxa identified as annuals in 2002.

Area	Number of Taxa of Known Duration	Number of Annuals	Percent Annuals
Kingman Area 1	37	13	35
Kingman Area 2	22	6	27
Kenilworth MF1	40	17	43
Kenilworth MF2	24	6	25
Dueling Creek	28	8	29
Patuxent	32	11	34

Table 6. Proportion of taxa identified as exotics in 2002.

Area	Number of Taxa of Known Origin	Number of Exotics	Percent Exotics
Kingman Area 1	41	5	12
Kingman Area 2	22	3	14
Kenilworth MF1	39	7	18
Kenilworth MF2	23	5	22
Dueling Creek	27	5	19
Patuxent	39	2	5

Figures

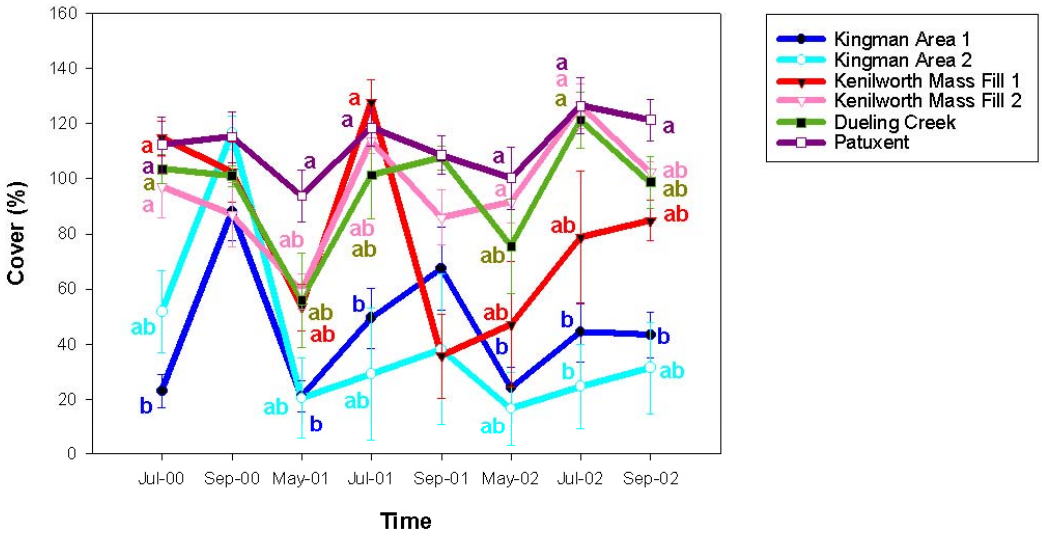


Figure 1a. Differences between areas within sampling events.

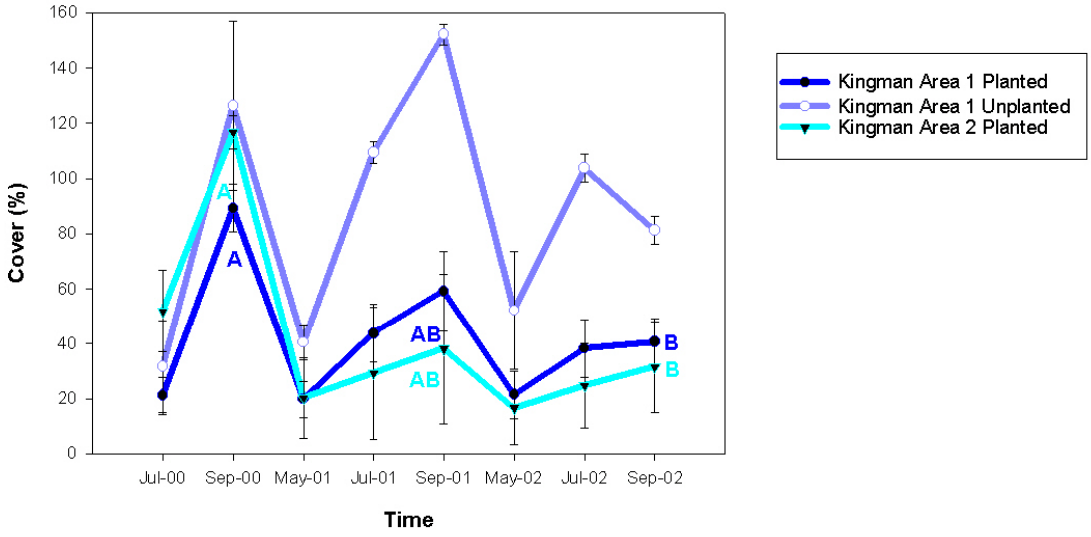


Figure 1b. Differences between years within areas at Kingman.

Figure 1. Total vegetative cover of areas over time.

Within a sampling event, means sharing the same lower-case letters are not significantly different. Within areas, means sharing the same upper-case letters are not significantly different from year to year (Tukey's Studentized Range Test of Least Squares Means; overall $\alpha = 0.05$).

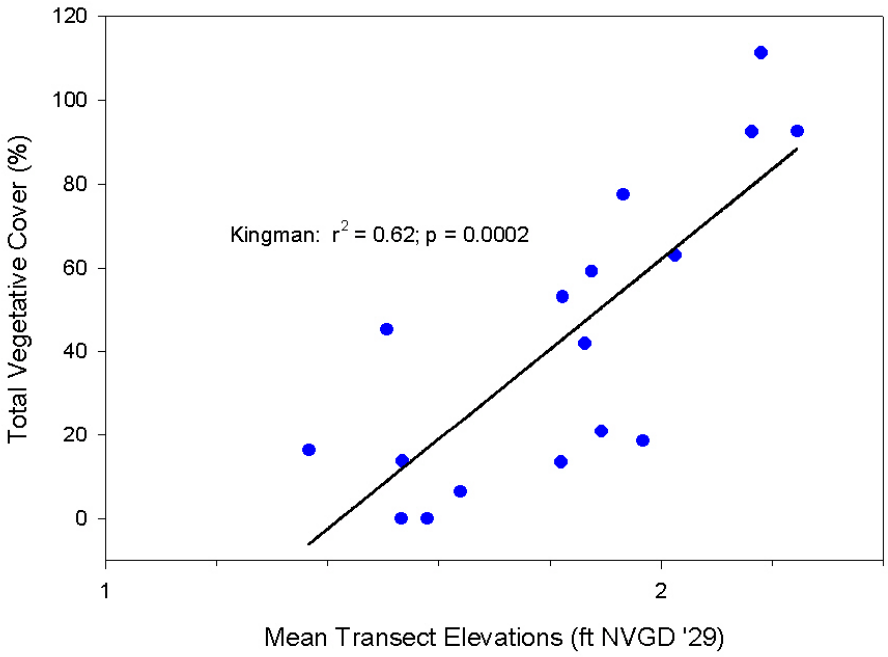


Figure 2. Total cover vs. elevation at Kingman.
Total vegetative cover is based on averages of July and September 2002 data. Point values are from 2001 as derived from mean transect elevations.

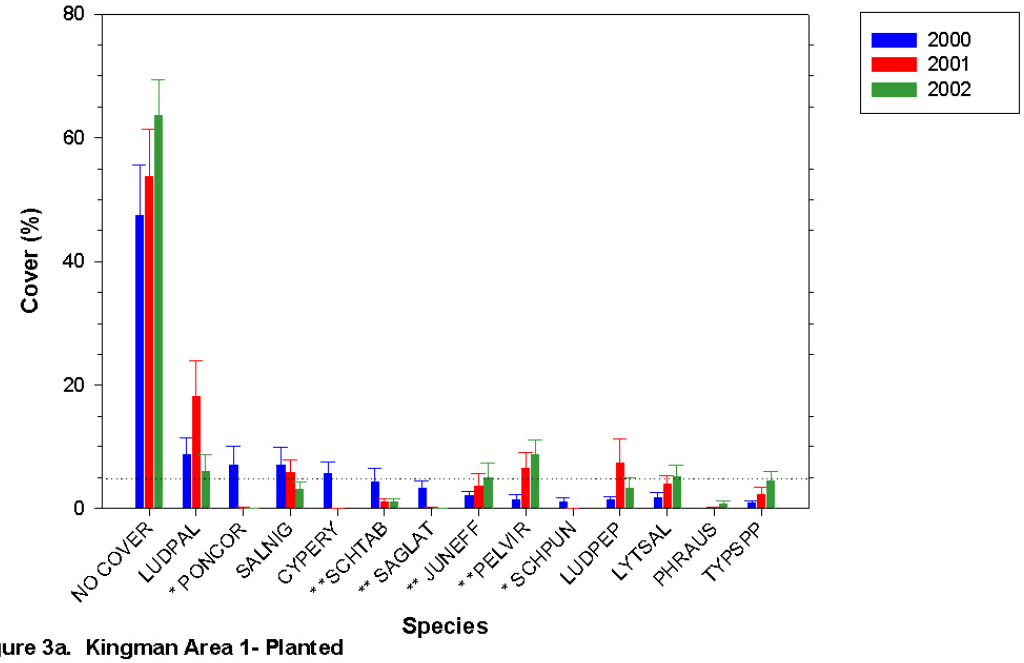


Figure 3a. Kingman Area 1- Planted

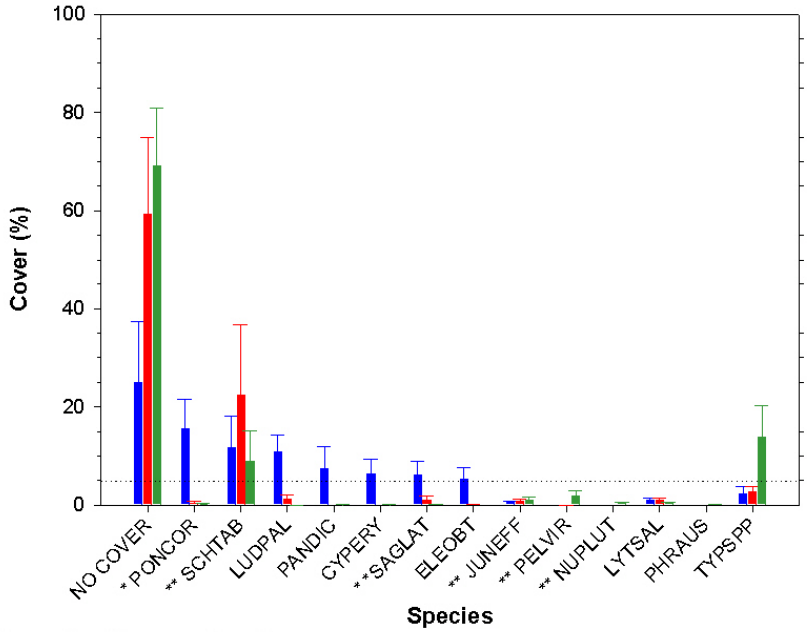


Figure 3b. Kingman Area 2

Figure 3. Cover by species. Values represent means (± SE) based on data from July and September of each year. Species shown consist of dominant species (at least 5% in July or September), species planted at Kingman (* planted in 2000, **replanted in 2000), and species of special concern (*Lythrum salicaria*, *Phragmites australis*, and *Typha* spp).

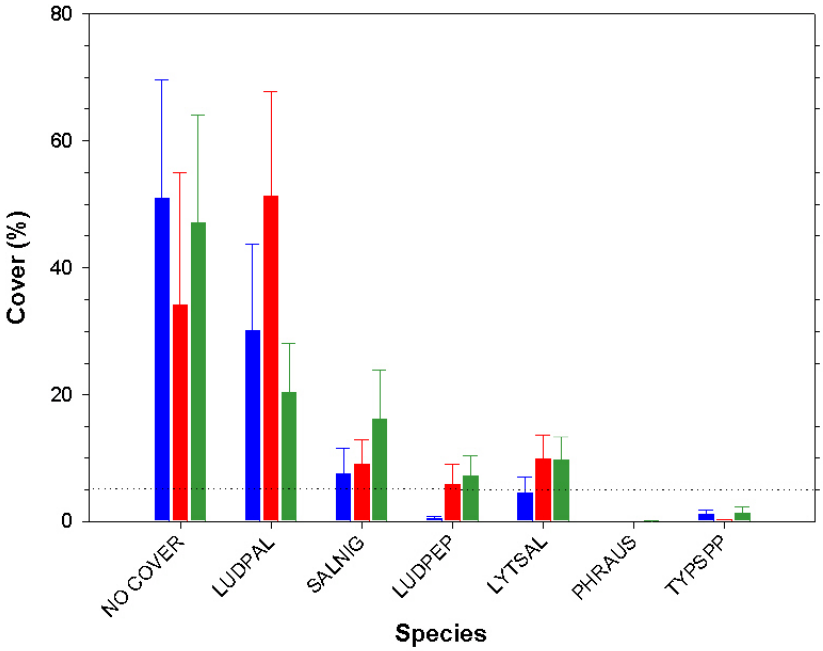
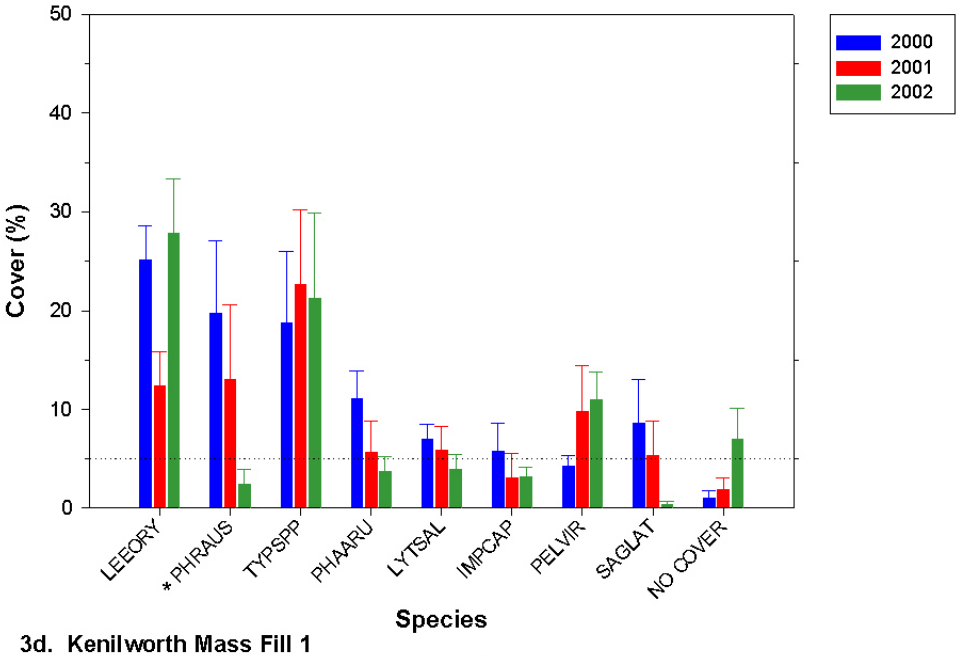


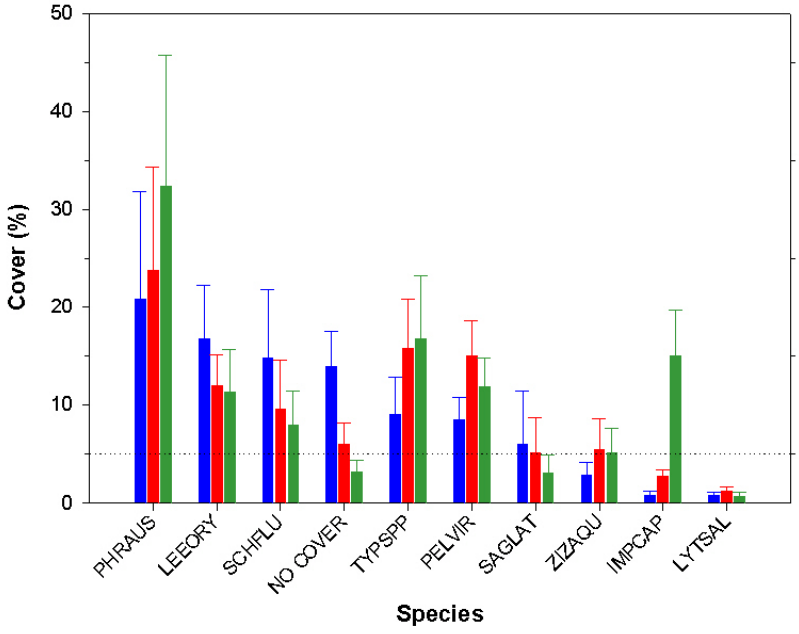
Figure 3c. Kingman Area 1 - Unplanted

Figure 3. Cover by species (Continued).



3d. Kenilworth Mass Fill 1

* Reduced by targeted Rodeo spraying in 2001.



3e. Kenilworth Mass Fill 2

Figure 3. Cover by species (Continued).

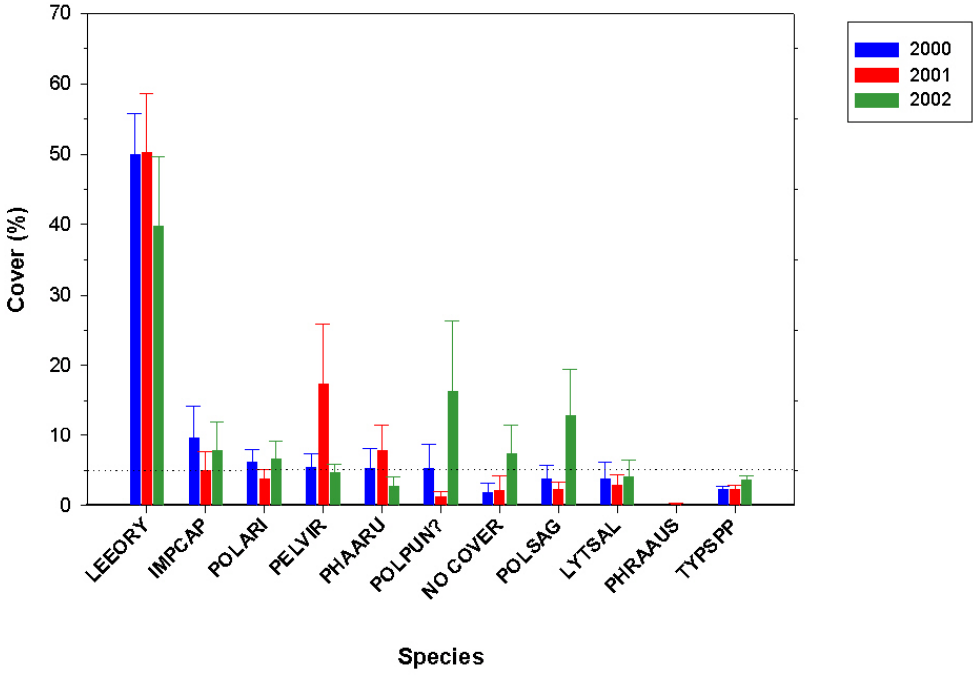


Figure 3f. Dueling Creek

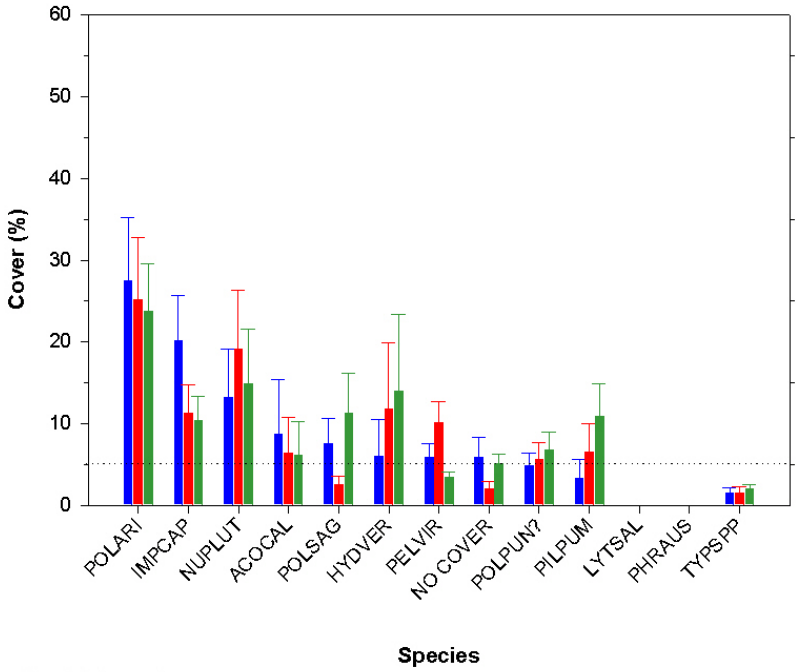


Figure 3g. Patuxent

Figure 3. Cover by species (Continued).

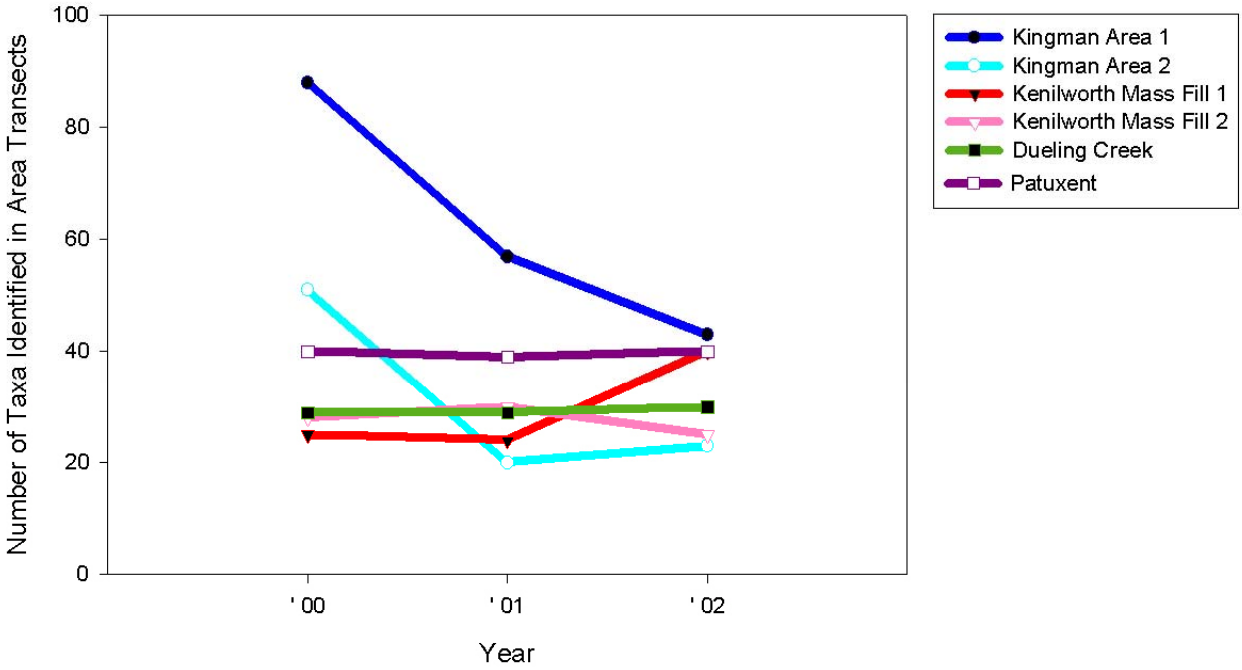


Figure 4a1. Species richness over time.
Number of species per area based on data from unequal number of transects per area (See Table 5).

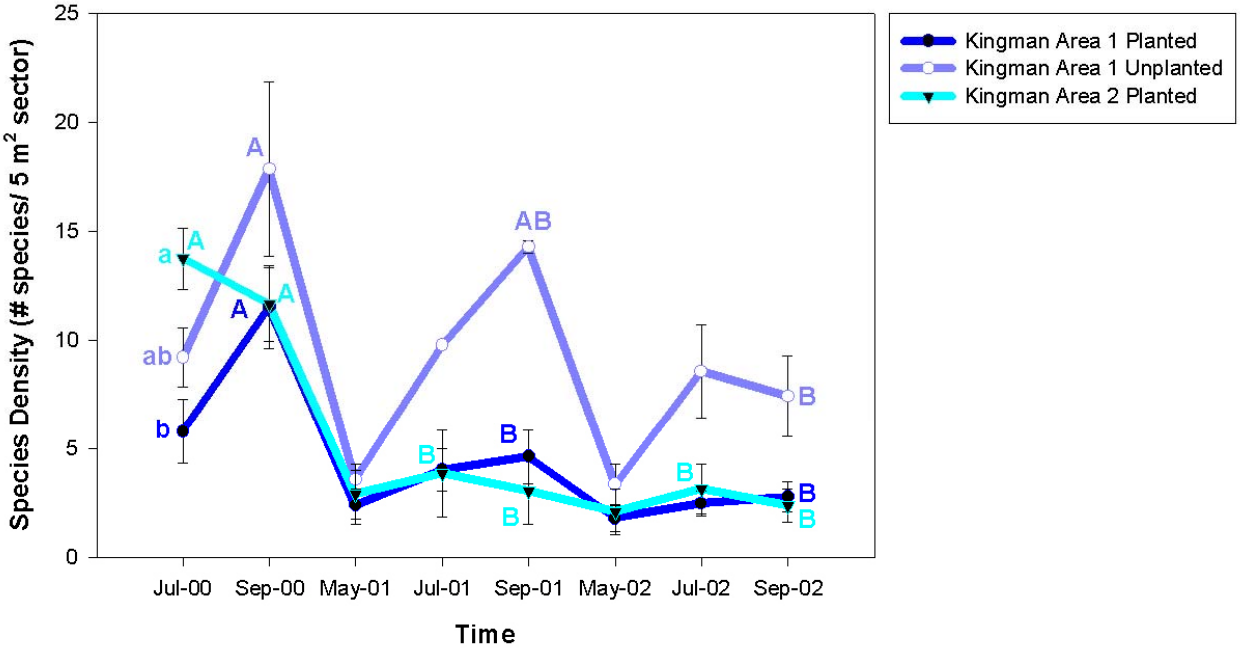


Figure 4a. Kingman- Planted and Unplanted.
Unplanted was based on transects U1 and U2 only.

Figures 4a-4c. Species density over time.
Number of species per 5 square meter sector. Within a sampling event, means sharing the same lower-case letters are not significantly different. Within areas, means sharing the same upper-case letters are not significantly different from year to year (Tukey's Studentized Range Test of Least Squares Means; overall $\alpha = 0.05$).

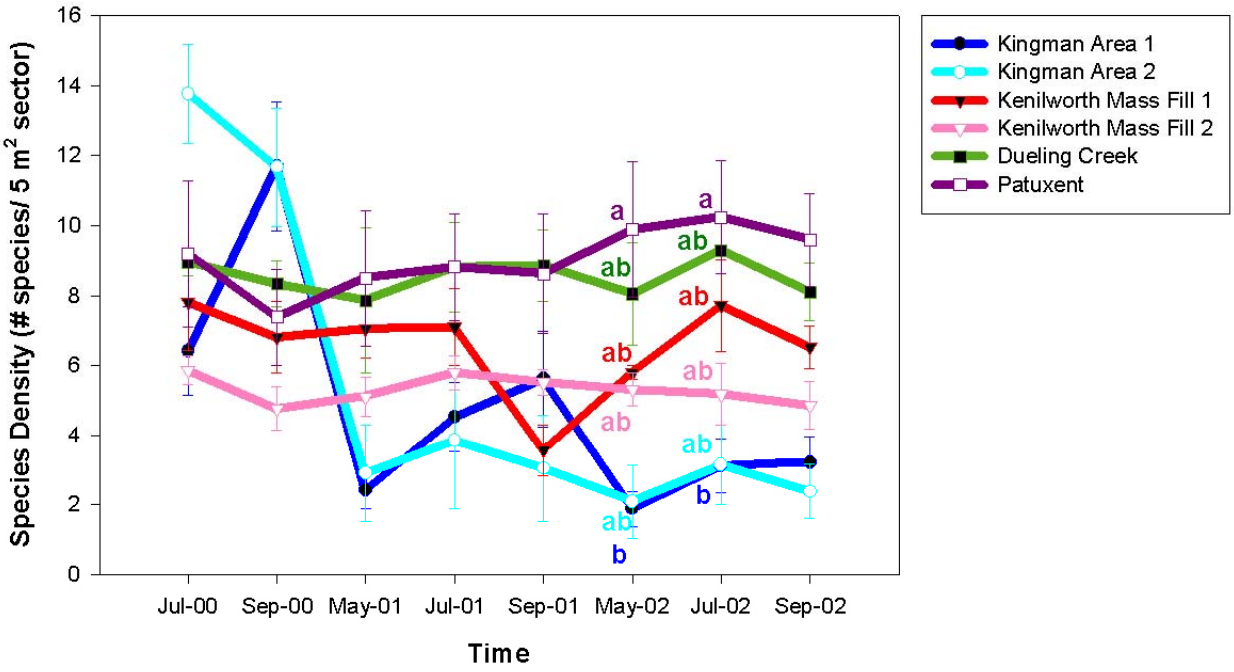


Figure 4b. All areas- differences between areas within sampling events

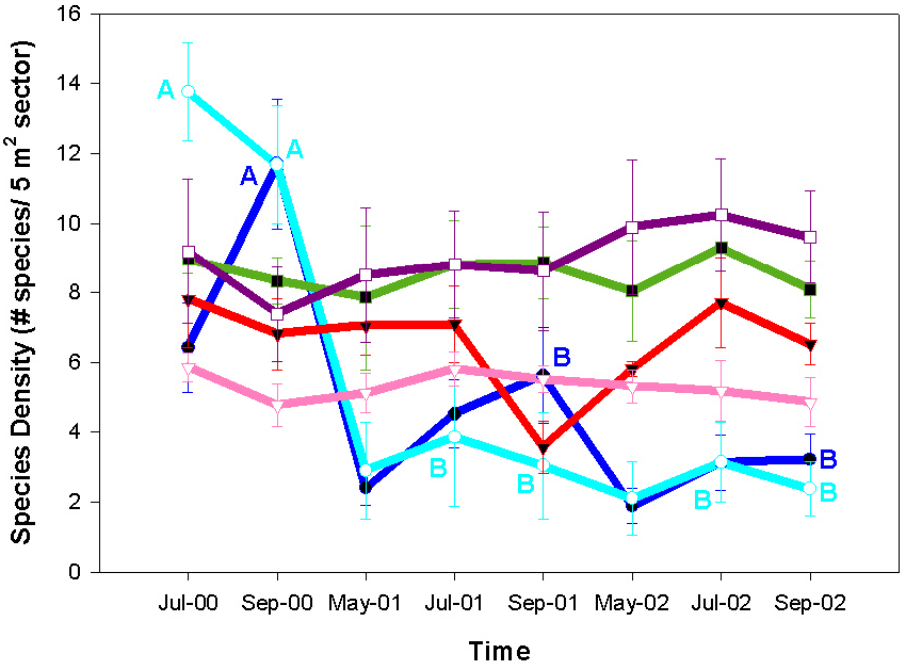


Figure 4c. All areas- differences between years within areas

Figure 4. Species density over time (Continued).

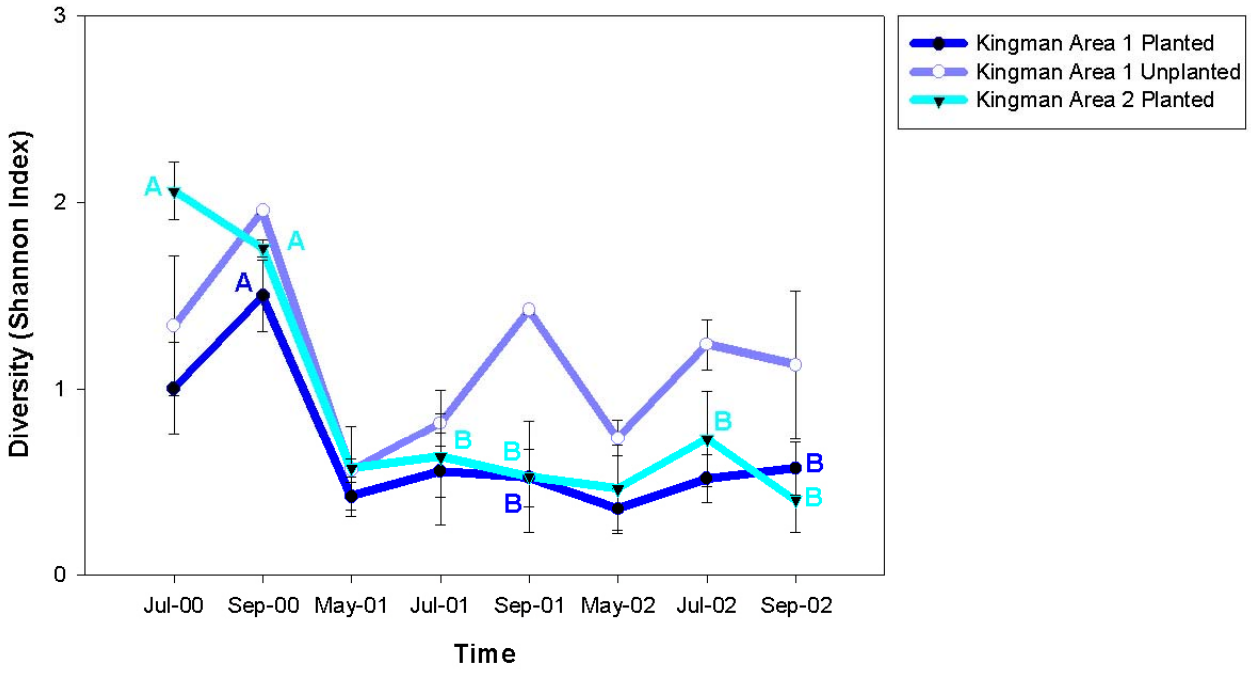


Figure 5a. Kingman- Planted vs Unplanted.
Unplanted was based on transects U1 and U2 only.

Figure 5. Diversity over tIme.

The Shannon Index was used as a measure of plant diversity. Within a sampling event, means sharing the same lower-case letters are not significantly different. Within areas, means sharing the same upper-case letters are not significantly different from year to year (Tukey's Studentized Range Test of Least Squares Means; overall $\alpha = 0.05$).

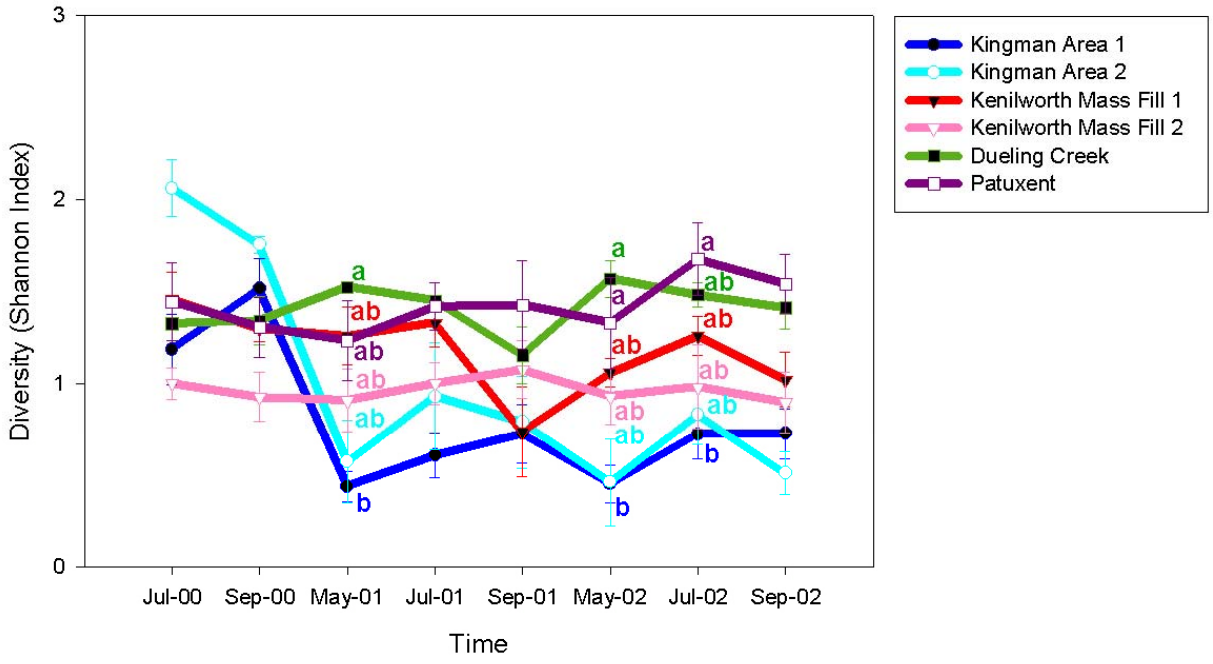


Figure 5b. All areas- differences between areas within sampling events

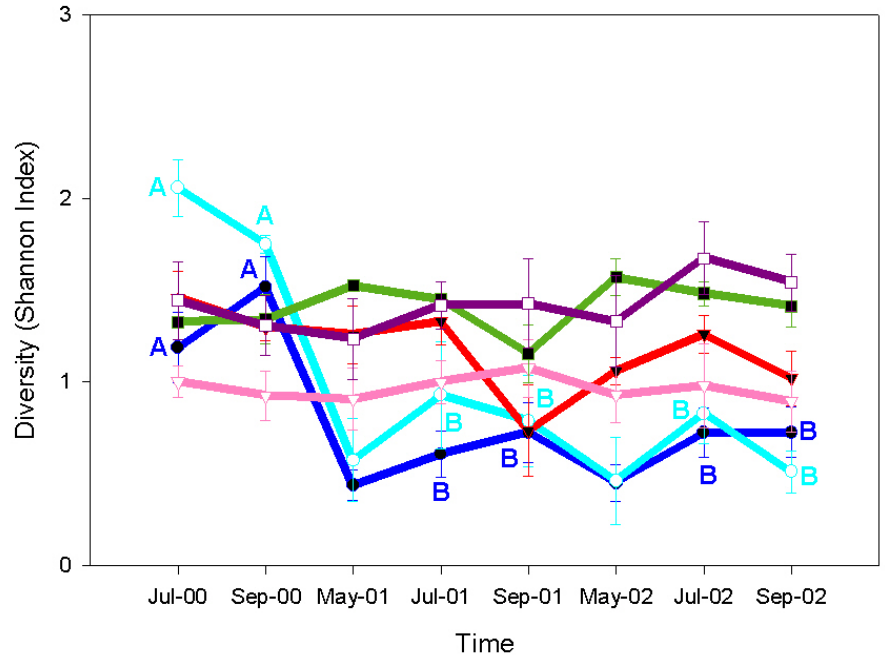


Figure 5c. All areas- differences between years within areas

Figure 5. Diversity over time (Continued).

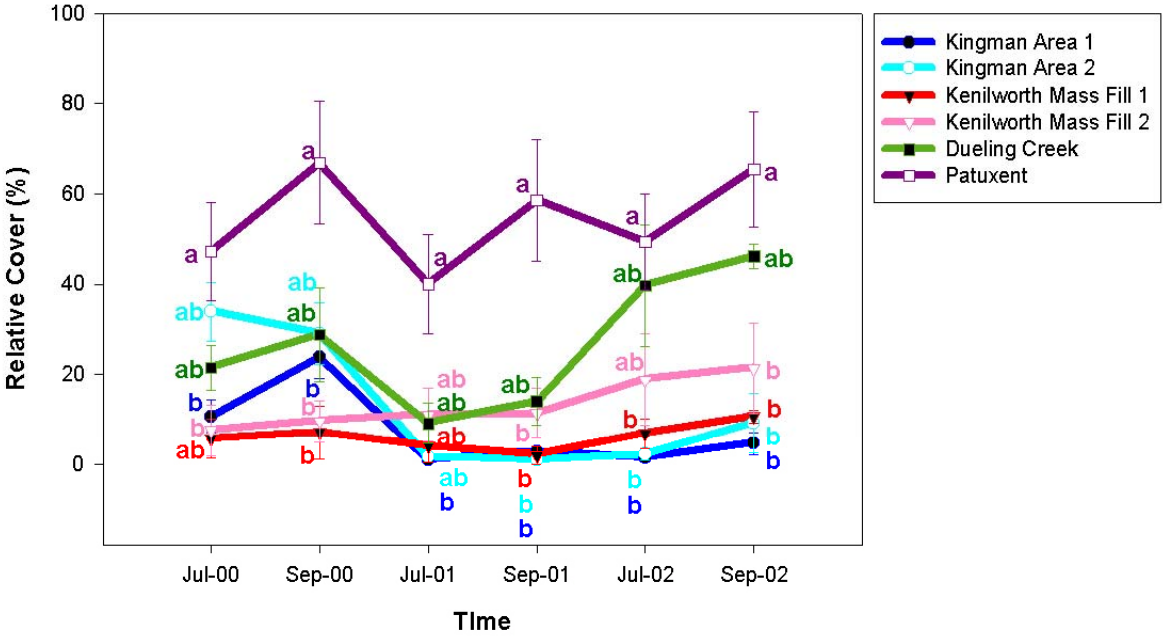


Figure 6a. Differences within sampling events.

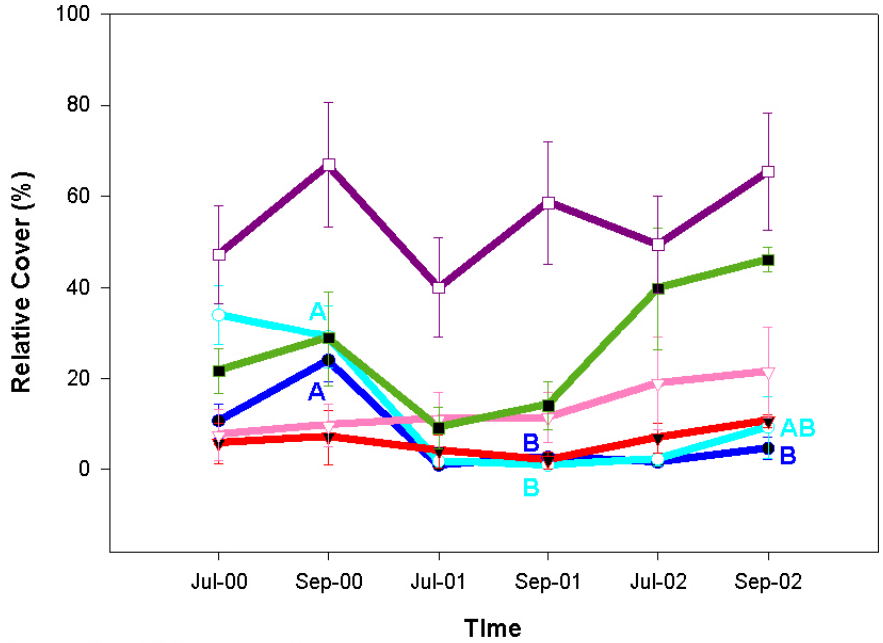


Figure 6b. Differences between years.

Figure 6. Proportion of cover contributed by annuals.
Within a sampling event, means sharing the same lower-case letters are not significantly different. Within areas, means sharing the same upper-case letters are not significantly different from year to year (Tukey's Studentized Range Test of Least Squares Means; overall $\alpha = 0.05$).

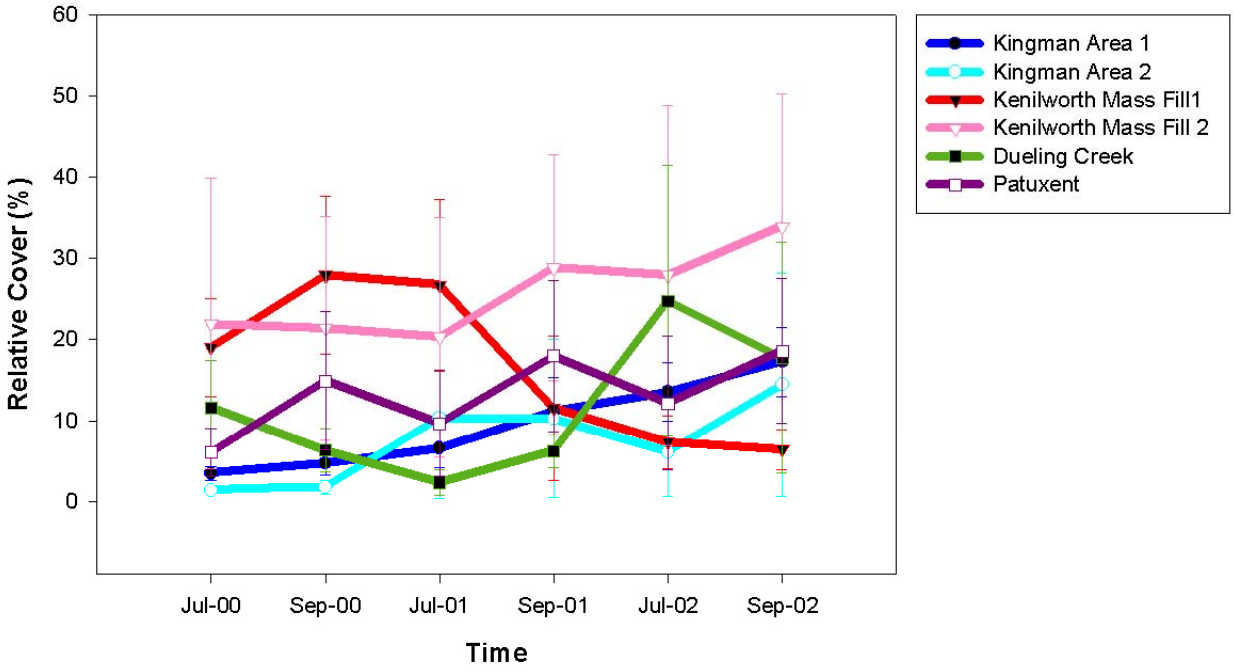


Figure 7. Proportion of cover contributed by exotics.
There were no significant differences within sampling events or between years.

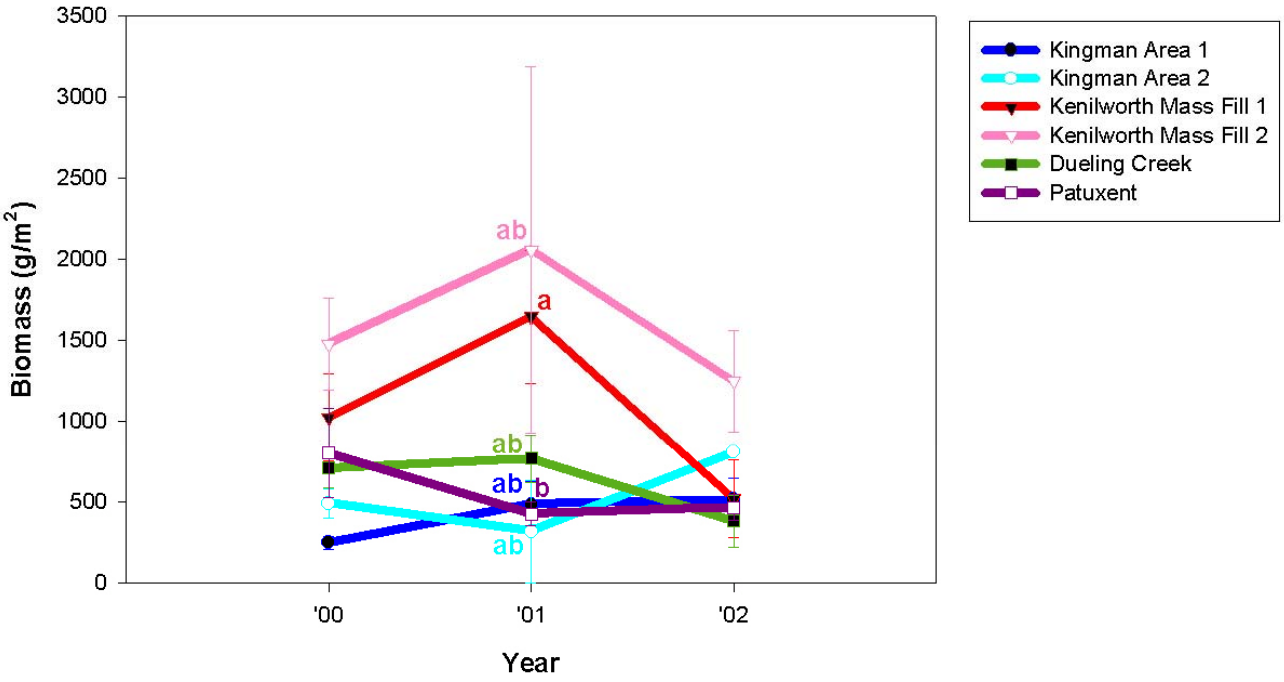


Figure 8. Biomass (of living plant material) over time.
Within a sampling event, means sharing the same lower-case letters are not significantly different. Within areas, means sharing the same upper-case letters are not significantly different from year to year (Tukey's Studentized Range Test of Least Squares Means; overall $\alpha = 0.05$).

Second Annual Report
Avian Comparisons between Kingman and Kenilworth Marshes Year 2
December 2001- November 2002

Mary M. Paul
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Laurel, MD 20748

INTRODUCTION:

As part of the effort to improve the aesthetics, water quality and habitat of the Anacostia watershed in Washington, D.C., the U.S. Army Corps pf Engineers (COE) in concert with the District of Columbia (D.C.) are reconstructing several wetlands. Such freshwater tidal marshes process pollution while providing habitat, food and nesting areas for a variety of wildlife. Two such wetlands are Kenilworth Marsh (32 acres), which was reconstructed in 1993 and Kingman Marsh (35 acres), which was just reconstructed in 2000, seven years after Kenilworth. Kenilworth Marsh surrounds Kenilworth Aquatic Gardens, a National Park Service (NPS) cultural site, while the 18-hole Langston Golf Course surrounds Kingman Marsh, which is a half-mile downstream from Kenilworth Marsh. To assist the evaluation of restoration success, the USGS Patuxent Wildlife Research Center (PWRC) as part of a five-year post-reconstruction monitoring program is conducting the monitoring of these marshes for avian richness and diversity for Kingman Marsh.

METHODS:

While both reconstructed wetlands themselves are structurally similar, the subtle variations in surrounding landscapes may have important ramifications for wildlife using the area, especially the birds. The golf course open space bordered with thin woody riparian zones and meadows immediately adjacent to Kingman Marsh correspondingly attracts species utilizing that kind of habitat, including resident Canada Geese. On the other hand Kenilworth is bordered by swamp forest and woods for the most part with open recreational parkland well set back from the wetland. The 0.7-mile route for bird observations along Kingman Marsh moves along the thin woody riparian edge with adjacent meadow being mowed occasionally but the fairways quite frequently. Unfortunately, the meadow edges were also mowed frequently inside the established borderline. The 0.7-mile walk along the River Trail at Kenilworth however is more within the forested buffer zone around the marsh while an additional observation route involves the recently constructed boardwalk overlooking the marsh.

Kingman has six points where 5-minute timed counts were conducted for each weekly survey. These points initially consisted of 1 open water area, 3 wetland edge/open water or mudflat areas (depending on the height of the tide) and 2 primarily wetland areas. With the decimation of the plantings in 2001, primarily from goose grazing, this habitat has changed drastically in year two in some areas. Kenilworth

consists of five 5-minute point counts to include 1 open water area, 2 wetland edge/open water or mudflat areas and 2 primarily wetland areas. Based on these we will want to assess how well the avian populations or portions thereof reflect the status of the reconstructed wetlands. The sites were surveyed weekly to encounter alternate high and low tide conditions; while the marsh first sampled each week was also alternated to increase likelihood of encountering songbirds in the earlier part of the day.

This study is primarily focusing on the wetland bird species but all avian species in all surveyed areas are included in this report. By December 2004 we hope to determine if the two sites are converging in species abundance and diversity which would suggest that Kingman Marsh is maturing to a status similar to that of Kenilworth which was reconstructed seven years prior.

RESULTS:

A total of 148 avian species were observed at both sites combined in 2002. Most of the birds included in this list are attracted to the system of wetlands and other habitats associated with water. Since the marsh was reconstructed there may be a greater number of birds and additional species using it. This represents 68% of all of the species reported to the Maryland Ornithological Society's District of Columbia Composite bird list for 2002 (http://www.mdbirds.org/lists/comp03dc.html). Birds were represented from 13 orders and 38 families. In 2001, 129 different species were observed between the two sites. From May-November 2002 there were two observers so this may have had some impact on the greater number of species observed. There were 16 species observed in 2001 that were not observed in 2002 but 30 new species added to the cumulative list between the sites in year two. This may be due in part to annual variations and whether the survey dates coincided with the times when migrants happen to pass through. Kenilworth had a total of 129 species in 2002. This is an increase of (17%) from 107 counted in 2001. Kingman had a total of 120 species, which is up from 104 (13%) counted in 2001. The similarity species composition between the two sites is pretty high (Sørenson's Similarity Index = 0.80) between the two sites in 2002 and 0.77 in 2001. Kenilworth had a slight increase in species richness from Kingman in 2002 (6%) and from itself between 2001 and 2002 (5%). There were 101 species in common between the two sites in 2002 compared to 81 in 2001. Thus 68% of the total birds observed were common to both sites in year 2 compared to 63% in year 1. There were 117 species common to both sites in both years. Certainly some of these species commute between the two sites.

Ruddy Duck, and American Coot were present prior to the completion of the physical reconstruction of Kingman Marsh (7/2000) but not since. In the Year 1 Report it was noted that Wood Duck was not observed since the completion of Kingman Marsh but it was observed there on 9 occasions with 23 birds counted in 2002. This is 2.5x the number of observations at Kenilworth (23) with Kenilworth counting 4.6x as many Wood Ducks (70) cumulatively annually. There were 28 species unique to Kenilworth (same as 2001) and 19 species exclusive to Kingman (down 4 from 2001). (See table 1). Thirty-six percent (10) of the species exclusive to Kenilworth were the same species that were

exclusive there in 2001. Fifty-seven percent (16) of the species exclusive to Kenilworth were new to the species list at both sites. Pied-billed Grebe, which was exclusive to Kingman in 2001, was observed at Kenilworth only on one occasion in 2002. Northern Pintail was unique to Kenilworth in 2002 but was observed at both sites in 2001, which is interesting because it visited Kingman more frequently in 2001 and in greater numbers as well. This could just be an annual difference. At Kingman 47% (9) of the species that were unique to that site were the same as in 2001. Forty-two percent (8) were also new to the cumulative species list for both sites. Sharp-shinned Hawk was unique to Kingman in year two but was present at both sites in year 1. Lesser Yellowlegs was observed only at Kingman in 2002 but was only observed at Kenilworth in 2001. Four species observed had the exact frequency as well as numbers counted at both sites (Table 6). They were Common Merganser (1), Cooper's Hawk (4), Ruby-throated Hummingbird (3) and Swainson's Thrush (2). It is interesting to find there are some species in the same proportion and frequency at both sites. It may be coincidental that these birds happen o occur in the same proportion so therefore both habitats must be similar enough for this to occur. Two of these were also new to the list this year. Last year there were four other species with equal counts (see 1st year annual report). The two sites share seventeen of the top twenty birds in total count in year two (Table2). Although some species may have high counts, such as Cedar Waxwings, they may not occur very frequently. Four of the top 20 are non-native residents to Maryland.

Results by Bird Scientific Order

The birds will now be looked at in further detail in taxonomic order and will be grouped together by order except passerines will be examined down to family. There were 29 species that had a greater percentage (70-99%) at Kingman while there were 23 species with a greater percentage at Kenilworth (See table 3). Freshwater marshes are considered habitat for 9 of these birds at Kingman and 5 of these birds at Kenilworth

Heron and Egret

There were a total of five species of herons observed between the two sites in 2002 as compared to 8 species in 2001. The three species absent in 2002 were only observed 1-3 times in the previous year. Each site had 4 out of 5 of the species with one species unique to each site. Great Blue Heron, Great Egret and Black-crowned Night Heron were observed more frequently and had a greater percentage at Kingman then at Kenilworth. Little Blue Heron was observed solely at Kenilworth and Green Heron was observed with a greater percentage (77) than at Kingman.

Ducks & Geese

Twelve species of waterfowl were observed between the two sites in 2002 as compared to 14 in 2001. The three species (American Widgeon, Northern Shoveler, and Ring-necked Duck) that were observed in 2001 and not in 2002 were only observed 1-2 times and all at Kenilworth. Kingman had slightly greater species diversity with respect to waterfowl and greater species richness. Much of this is due to the overwhelming numbers of Canada Geese. Even excluding the Canada Geese, Kingman still had 12%

greater numbers of waterfowl counted. Canada Goose and Mallard were the top two waterfowl species in overall numbers at both sites. Both species are non-native breeders to Maryland. Kingman probably looks very attractive to the geese due to the adjacent golf course with the wide-open space and green grass. Kenilworth does not have the wide-open green grassy areas immediately adjacent like Kingman. Wood Ducks and Black Ducks seemed to prefer Kenilworth in year two as in year one, possibly due to a couple of secluded coves that they favored. There is great concern with the numbers of resident Canada Geese at Kingman due to their impact on the vegetation. While the total numbers of geese counted at Kingman were up 7% from 2001, they were down 60% at Kenilworth from 2001. It seems that some of these geese may be moving over to Kingman were there is a freshly planted marsh in which to feed. The numbers at Kenilworth drastically declined in the summer and fall of 2002 (See Table 3). The numbers in the Table are cumulative counts by season. There were 737 individuals counted on one survey at Kingman with an average of 230 per survey. The highest count at Kenilworth on one visit was 452. Both of these high counts were in the winter. The numbers vary weekly, by season and by tide. On one count in October, there were no geese observed at all at either site.

Hawks

Kingman hosted more raptor species but Kenilworth came out on top in numbers as well as frequency as in 2001. All nine species observed were found at Kingman. Osprey and Red-shoulder Hawk were the top two in species richness at both sites. Red-shoulder Hawk inhabit Kenilworth year round and probably breed there as well.

Quail

Bobwhite were heard calling from the Kenilworth Park this year on three occasions. Last year it was heard once from Kenilworth but was probably calling from the National Arboretum. This is good news since this bird has been absent in recent years due to loss of habitat.

Plovers, Sandpipers, Gulls & Terns

Kingman is a good place for shorebirds during migration. Kingman hosted both more species (12/13 total observed between both sites) and greater numbers of shorebirds (661 vs. 298). Kingman is one of the best places in D.C. to observe shorebirds. This may be correlated with the abundance of invertebrates found in the research study, "Benthic Macroinvertebrate Populations of Urban Freshwater Tidal Wetlands in the Anacostia river, Washington D.C" under the direction of Kevin Brittingham. Additionally there are more open mudflats, which are due in part to the goose browsing of the vegetation. New to the species list this year were Dunlin that were observed one time at Kenilworth. There were seven species of gulls and terns observed between the two sites. While the species diversity was the same, Kingman had almost twice as many gulls and terns counted, as did Kenilworth. New to the list this year was a Forster's Tern observed one time at Kenilworth. Absent this year was a Least Tern that was sighted one time at Kingman in 2001.

Swift, Hummingbird & Kingfisher

Chimney Swifts were quite abundant at both sites although they occurred slightly more frequently and in slightly greater numbers at Kingman. New to the list this year in this same order of Apodiformes was Ruby-throated Hummingbird, which was seen at both sites. Belted Kingfisher occurred more frequently at Kenilworth as it did in year 1.

Woodpeckers

Kenilworth was ahead in both richness (275 vs.114) and diversity (6 vs.5) in woodpecker species. All six of the species that are expected to be seen in this area have been sighted at Kenilworth. Yellow-bellied Sapsuckers were absent from Kingman.

Songbirds

The last order to be looked at is Passeriformes (songbirds). Eighty-five species from twenty-two families were observed in 2002. Seven species of flycatchers were observed this year. All seven were found at Kenilworth. Kenilworth had 12% more flycatchers totaled then Kingman. The top two species observed were Eastern Phoebe and Eastern Kingbird that nested at both sites.

Both sites collectively were visited by all four possible vireo species. Philadelphia Vireo was absent from Kingman. Vireos were more abundant and frequent at Kenilworth than Kingman. Crows and Jays were greater in frequency and total counted at Kenilworth. The total numbers of this group were down from 2001 by 64%. This brings to mind West Nile Virus that is caused by the Asian tiger mosquito, which is frequently prevalent in Crows and Jays. One cannot say for certain if this decrease in numbers is due to the virus but it is something to follow. Swallows frequented both sites with Kingman having one more species then Kenilworth. The count at Kenilworth was slightly higher. Four species were observed this year as compared to six species in 2001. Bank and Cliff Swallows were not observed in migration at either site. Purple Martin was observed at Kingman but lacking at Kenilworth again in year two. Both sites were about equal in total numbers of Northern Rough-winged and Barn Swallows with the former being slightly more frequent at Kingman. Tree Swallows were more frequent and numerous at Kenilworth as in year one. Dr. Mark J. Melancon is using tree Swallows as a sentinel species for contaminant research as mentioned in the year 1 annual report.

Carolina Chickadee and Tufted Titmouse were more frequent and numerous at Kenilworth which is expected due to the forested habitat along the River Trail. Also in this habitat were White-breasted Nuthatch and Brown Creeper that are lacking at Kingman. With respect to wrens, House and Marsh Wren occurred more frequently and in greater numbers at Kingman and nested there as well. However Carolina Wren and Winter Wren occurred more frequently and were more numerous at Kenilworth. No Golden-crowned Kinglets were observed at Kingman but Ruby-crowned Kinglet occurred at both sites with Kenilworth having them twice as more frequently and with higher total numbers. Blue-gray Gnatcatchers were observed at Kenilworth in greater

frequency and numbers on the order of four fold. Six of the seven species of thrushes that occur in D.C. were observed between the two sites. Both sites were equal in relative species richness but Kenilworth had greater abundance. Eastern Bluebirds were more frequent and numerous at the golf course then at the aquatic gardens. Gray-checked Thrush occurred once in migration at Kingman only. Wood Thrush was exclusive to Kenilworth. The top thrush species was American Robin.

Of the mimid species, only Northern Mockingbird (104) occurred more frequently and in greater numbers at Kingman. Both sites had all three mimid species that occur in D.C. European Starlings (1766) were again quite numerous at Kingman. Starlings occurred three times more frequently at Kingman and with nearly four times as many in the total count. Cedar Waxwing numbers at Kingman (472) were 2.5x as great as Kenilworth (181) with fewer occurrences.

Nineteen species of warblers occurred between the two sites in 2002. Of these, nine are considered migratory, nine could potentially breed in the District of Columbia and one is a winter resident. Kingman had eight species of warblers with Bay-breasted occurring exclusively there during migration. Kenilworth had 18 species of warblers. Kenilworth counted 2.4x as many total warblers as Kingman. Yellow Warbler (18), Blackpoll (12) and Northern Waterthrush (8) were more frequent and numerous at Kingman while all other species were more abundant and frequent at Kenilworth. On the other hand the place for sparrows was Kingman again in 2002. Nine species of sparrows were seen between the two sites. All nine were observed at Kingman and seven species were observed at Kenilworth. In 2001, seven species of sparrows were observed at Kingman. Kenilworth had 59% (673) of the total number of sparrows counted that at Kingman.

BREEDING BIRDS:

Twenty-seven species of birds were observed with evidence of breeding (as defined by the Second Maryland/DC Breeding Bird Atlas Project Handbook) at Kingman and thirty-one species were observed at Kenilworth (see Table 5B). That is there were 13% more breeders at Kenilworth. The habitat is probably generally more suitable and attractive at Kenilworth especially with the wooded trail and less disturbance (golfers). Providing suitable nesting habitat for food and cover insures the species will succeed and return in following years. They had sixteen nesting species in common. The results for the Second Maryland/DC Breeding Bird Atlas Project for these to areas were given to the coordinator for the District of Columbia. Of interest this year was the fact that the Marsh Wren started off singing in Kenilworth Marsh near the area where it nested in 2001. It later moved and nested at Kingman Marsh. We will see where they return in 2003. In the area (Mass Fill 3) where it nested in the first year, a Willow Flycatcher nested there in the second year. This is a relatively small area dominated by cattail, phragmites, and some willow trees.

CONCLUSIONS:

In summary, the overall relative species richness between the two sites is fairly equal as in year one. Most of the same trends occurred between the two sites as in year one, such as greater numbers of herons, waterfowl, gulls, terns, and shorebirds at Kingman. Kenilworth has greater numbers of raptors, woodpeckers, vireos, and warblers. Each site has it pluses and minuses. While Kingman has greater numbers of Great Blue Heron, Great Egret, and Black-crowned Night Heron, Kenilworth has greater numbers of Green Herons. Overall Kingman has more waterfowl abundance richness but Kenilworth has greater numbers of American Black Duck and Wood Duck. Kingman has greater species richness with respect to raptors but Kenilworth has greater numbers and occurrences. Kingman is also home to a greater species richness and abundance of shorebirds. While the species richness of gulls and terns is about equal between the two sites, Kingman has greater abundance of these species. Kenilworth succeeds with respect to woodpecker species richness as well as the number and frequency of vireos. There is not a great difference is the abundance and species richness of swallows at either site. Tree Swallows were a little more numerous at Kenilworth. Carolina Chickadee and Tufted Titmouse were more frequent and abundant at Kenilworth. House Wren and Marsh Wren preferred Kingman and bred there but Carolina and Winter Wren were more frequent and numerous at Kenilworth. Kinglets and gnatcatchers appeared more frequently and in greater numbers at Kenilworth. Both sites were equal in species richness of thrushes but Kenilworth had a greater abundance except for Eastern Bluebirds preferred Kingman. Northern Mockingbirds were more numerous and frequent at Kingman whereas Brown Thrasher and Gray Catbird were more abundant and frequent at Kenilworth. Unfortunately European Starlings were in much greater numbers and occurrences at Kingman. Cedar Waxwings were more numerous and frequent at Kingman. Without a doubt, Kenilworth is the place for warblers. It excels in species richness. Kingman has a greater abundance of sparrow species and in greater numbers. Kenilworth came out ahead as far as numbers of species that bread there.

It is far to early to say with definitiveness that one site is more suitable habitat then the other for birds. Seven-six percent of Kingman's species and seventy-seven percent of Kenilworth's species were wetland or other water associated habitat birds. Of the total annual counts 83% of Kingman's and 74% of Kenilworth's were wetland or other aquatic type habitat birds. Since a large proportion of these birds were Canada Geese I subtracted them out and the result were 67% at Kingman and 69% at Kenilworth. So you can see they are very similar with respect to number of wetland system species as well as the percentage of those total counted.

Kenilworth was established seven years prior to Kingman and has had time to grow lusher. Kenilworth has been impacted by the spread of non-native invasives, such as *Phragmites*, and has been treated with herbicide to control it. There are only 8 species of birds that use wetlands and other water associated habitats that are more attracted to Kenilworth. It has not had the extent of the pressures of the goose grazing that Kingman has faced. Kingman is not nearly as far along as expected to be. The value of the birds to

measure the progress of the marsh has been set back. Even with this set back Kingman still attracts many species as well as numbers of birds. With time and proper management if the marsh can flourish again we may see better results. With the establishment of the marsh, it has provided nesting habitat for Marsh Wren, Common Yellowthroat and Red-winged Blackbird. It has also provided cover for such species as Wood Duck and Common Snipe that were not noted very often if at all before reconstruction. Even with the decimation of the wetland, mudflat areas have been created in its place, which provide valuable habitat and food resources for migrating shorebirds. If Kingman can increase and maintain its plantings it may be even more beneficial to birds then Kenilworth.

Table 1
Species solely observed at Kenilworth vs. Kingman in 2002
* Denotes wetland species

Kenilworth	Kingman
Pied-billed Grebe	Black-crowned Night Heron *
Little Blue Heron *	Snow Goose *
Northern Pintail *	Blue-winged Teal *
Northern Bobwhite	Other hybrid Goose (white)
Dunlin *	Northern Harrier *
Forster's Tern	Sharp-shinned Hawk
Yellow-bellied Sapsucker	Semi-palmated Plover
Acadian Flycatcher	Lesser Yellowlegs *
Least Flycatcher	Semipalmated Sandpiper
Philadelphia Vireo	Western Sandpiper
White-breasted Nuthatch	White-rumped Sandpiper
Brown Creeper	Pectoral Sandpiper *
Golden-crowned Kinglet	Lesser Black-backed Gull
Wood Thrush	Purple Martin
Nashville Warbler	Gray-cheecked Thrush
Northern Parula	Bay-breasted Warbler
Magnolia Warbler	Savannah Sparrow
Black-throated Blue Warbler	White-crowned Sparrow
Black-throated Green Warbler	Bobolink *
Blackburnian Warbler	
Prairie Warbler	
Black-and-White Warbler	
Prothonotary Warbler	
Louisiana Waterthrush	
Kentucky Warbler	
Scarlet Tanager	
Rose-breasted Grosbeak	
Rusty Blackbird *	

Table 2
Top 20 birds at each site by total numbers December 2001- November 2002

Kingman	**Kenilworth**
Canada Goose	Canada Goose
European Starling	Red-winged Blackbird
Ring-billed Gull	Mallard
Mallard	Ringed-billed Gull
Song Sparrow	American Crow
Fish Crow	European Starling
Cedar Waxwing	Chimney Swift
Chimney Swift	White-throated Sparrow
Red-winged Blackbird	Northern Cardinal
Killdeer	American Robin
House Finch	Song Sparrow
Great Blue Heron	Carolina Wren
Northern Cardinal	Killdeer
American Crow	Carolina Chickadee
White-throated Sparrow	Fish Crow
American Goldfinch	Cedar Waxwing
Carolina Wren	Barn Swallow
Great Egret	Downy Woodpecker
Barn Swallow	Great Blue Heron
Northern Mockingbird	Gray Catbird

Table 3
Kingman vs. Kenilworth species abundance greater than 70% of cumulative total
* Denotes wetland species

Kingman	%	Kenilworth	%
Double-crested Cormorant	73	Green Heron *	77
Great Blue Heron *	72	Turkey Vulture	70
Great Egret *	73	Wood Duck *	82
Canada Goose *	85	American Black Duck	96
Green-winged Teal *	71	American Kestrel	71
Domestic white Duck	94	Red-bellied Woodpecker	78
Solitary Sandpiper *	80	Hairy Woodpecker	86
Spotted Sandpiper	82	Pileated Woodpecker	71
Least Sandpiper *	83	Willow Flycatcher *	90
Common Snipe	99	Warbling Vireo	78
Laughing Gull	72	Red-eyed Vireo	79
Herring Gull	84	Blue Jay	77
Great Black-backed Gull	74	Carolina Chickadee	71
Rock Dove	89	Tufted Titmouse	87
Mourning Dove	78	Winter Wren	79
Fish Crow	72	Blue-gray Gnatcatcher	82
Horned Lark	70	Hermit Thrush	94
House Wren	79	American Robin	90
Marsh Wren *	83	Yellow-rumped Warbler *	89
European Starling	79	American Redstart	75
American Pipit	75	Common Yellowthroat *	77
Cedar Waxwing	72	Eastern Towhee	83
Blackpoll Warbler	86	Orchard Oriole	77
Northern Waterthrush *	89		
Song Sparrow	75		
Dark-eyed Junco	70		
Brown-headed Cowbird *	90		
House Finch	82		
House Sparrow	94		

Table 4
Kingman Total Canada Goose numbers
W = Dec- Feb; Sp = Mar-May; Su = Jun-Aug; F = Sep-Nov

	W	Sp	Su	F
2000		1970		
2001	2857	2828	2073	1840
2002	2915	2842	2822	1910

Kenilworth Total Canada Goose numbers

	W	**Sp**	**Su**	**F**
2001	918	220	533	1225
2002	1110	508	195	332

Table 5A
Breeding Birds* observed at Kingman and Kenilworth Aquatic Gardens in 2002
*As defined by the Breeding Bird Atlas Project Handbook

Kingman	Kenilworth
Canada Goose	Canada Goose
Mallard	American Blackduck
Red-shouldered Hawk	Mallard
Chimney Swift	Red-shouldered Hawk
Eastern Phoebe	Northern Bobwhite
Eastern Kingbird	Spotted Sandpiper
American Crow	Downy Woodpecker
Fish Crow	Hairy Woodpecker
Northern Rough-winged Swallow	Willow Flycatcher
Barn Swallow	Eastern Phoebe
Carolina Chickadee	Eastern Kingbird
Carolina Wren	Warbling Vireo
House Wren	Tree Swallow
Marsh Wren	Barn Swallow
Blue-gray Gnatcatcher	Carolina Chickadee
Northern Mockingbird	Tufted Titmouse
European Starling	Carolina Wren
Cedar Waxwing	Marsh Wren
Common Yellowthroat	House Wren
Song Sparrow	Blue-gray Gnatcatcher
Northern Cardinal	American Robin
Indigo Bunting	Cedar Waxwing
Red-winged Blackbird	Northern Parula
Common Grackle	Common Yellowthroat
Brown-headed Cowbird	Eastern Towhee
American Goldfinch	Swamp Sparrow
House Sparrow	Northern Cardinal
	Indigo Bunting
	Red-winged Blackbird
	Brown-headed Cowbird
	Orchard Oriole

Table 5B
Criteria of Breeding Birds of Kingman and Kenilworth Marshes 2002
As defined by Second Maryland/DC Breeding Bird Atlas Project Handbook

Kingman (Langston Golf Course area)

1.Canada Goose goslings observed 5/6/02: Confirmed – FL
2. Mallard ducklings observed 5/21 (1 duckling), 6/4/02 (3 ducklings) 6/28 (4 ducklings), 7/3(5 ducklings): Confirmed – FL
3. Red-shouldered Hawk young observed 6/28: Confirmed – FL
4.Chimney Swift seen carrying nesting material 6/19/02: Confirmed – NB
5A. Eastern Phoebe fledgling observed 6/28 and 8/26: Confirmed - FL
5B. Eastern Kingbird seen carrying nesting material 5/29/02: Confirmed – NB
6. American Crow adult carrying food for young 6/4/02: Confirmed – FY
7.Fish Crow pair copulating 5/29/02: Probable – C
8. Northern Rough-winged Swallow two family groups observed. Young with stubby tails 6/19/02: Confirmed – FL; also 5/6/02 adult carrying nesting material Confirmed –NB
9. Barn Swallow observed copulating 5/15/02: Probable – C; family group observed 6/28/02: Confirmed – FL
10. Carolina Chickadee family group observed 5/29/02,6/13/02, 6/19: Confirmed – FL
11. Carolina Wren family group heard on 7/12: Confirmed – FL
12. House Wren present at same location 5/29, 6/4, 6/13 and another area 6/4, 6/19, 6/28, 7/3, 7/12, 7/18: Probable – T
13. Marsh Wren singing male present and pair heard 6/13, 6/19, 6/28, 7/3, 7/12, 8/1, 8/8 (I think this pair moved from KAG (heard there 5/29 and 6/4): Probable – P and T
14. Blue-gray Gnatcatcher pair observed 5/21: Probable – P
15. Northern Mockingbird young observed 7/18: Confirmed – FL
16. European Starling family group heard 5/29,adult carrying food for young 5/24, 2 young observed 5/21 & 6/4; adult carrying nest material 6/13, adult carrying food for young 7/3: Confirmed – NB, FL + FY
17. Cedar Waxwing courtship feeding 5/21 (safe date = 6/15-7/31): Probable – C ???
Also heard one calling on 6/19: Probable – T
18A. Common Yellowthroat singing male present on 5/29, 6/19, 6/28, and 8/1: Probable - T
18. Song Sparrow – family group observed 6/28: Confirmed – FL; 6/19 singing male; Probable – T and courtship flight – C and 8/28 young observed; Confirmed – FL
19. Northern Cardinal – adult carrying food for young 5/29; Confirmed – FY; young calling 7/12; Confirmed – FL
20. Indigo Bunting – two males agitated. Nest close to each other 6/19;Probable – A
21. Red-winged Blackbird – Food for young 6/13 + 7/18; Confirmed – FY;
22. Common Grackle – Adult carrying food 5/15; Confirmed – FY; young observed 6/4; Confirmed – FL
23. Brown-headed Cowbird – female collecting nest material 4/30; Confirmed – NB; courtship display 6/13; Probable – C
24. American Goldfinch – courtship feeding 5/21 (outside safe date); observed one or more 6/19, 6/28, 7/3, 7/12, 7/18, 8/1, 8/8, 8/14 in suitable habitat; Probable – P
25. House Sparrow – Adult bird carrying food; Confirmed – FY

Kenilworth Aquatic Gardens and Kenilworth Park

1. Canada Goose goslings observed 5/15; Confirmed – FL
2. American Black Duck – ducklings observed 6/4 (5 ducklings), 7/3 (2 ducklings); Confirmed – FL
3. Mallard – 5/15 (1 duckling) 6/20 (6 ducklings), 8/1(1duckling); Confirmed - FL
4. Red-shouldered Hawk – one or more observed in suitable habitat 5/15, 5/21, 5/29, 6/28, 7/12, 7/18, 8/8, 8/14; Probable – P + observed Kenilworth Park 8/8; Probable – T
5. Northern Bobwhite – species heard in breeding habitat 5/29 and 6/13: Probable – T
6. Spotted Sandpiper – observed on 6/28 on mudflat: Possible – X
7. Downy Woodpecker – nest calling 5/21, nest in tree at end of boardwalk, 7/3 adult carrying food; Confirmed – FY + NY+ ON + Kenilworth Park 7/18 family group heard – Confirmed – FL
8. Hairy Woodpecker - pair observed 7/3: Probable – P
9. Willow Flycatcher seen in same location 6/4, 6/13, 6/20, 6/28, 7/12, 8/1; Probable- T
10. Eastern Phoebe young calling 5/21, 6/28 fledgling: Confirmed – FL
11. Eastern Kingbird food for young 6/28: Confirmed – FY
12. Warbling Vireo pair calling to each other 5/29, family group scolding BLJA 7/12; Confirmed – FL + Probable – T
13. Tree Swallow seen feeding young fledglings on 6/28 and 7/18: Confirmed – FL
14. Barn Swallow family group observed 6/28 Kenilworth Park: Confirmed – FL
15. Carolina Chickadee at least 3 family groups observed on several occasions (6/4, 6/13, 7/18, 6/19) along the River Trail + adult carrying food5/21: Confirmed: FL + FY
16. Tufted Titmouse family group heard before River Trail head 6/4/02: Confirmed – FL
17. Carolina Wren heard singing male present at same location throughout breeding season: Probable – T
18. Marsh Wren heard singing male 5/29, 6/4 then may have moved to Kingman: Probable – T
19. House Wren heard one and saw another in suitable habitat 7/3/02: Probable – T (P?)
20. Blue-gray Gnatcatcher feeding BHCO 6/20: Confirmed – FY
21. American Robin young begging for food 7/12 along boardwalk: Confirmed – FL
22. Cedar Waxwing calling at same location6/20, 6/28, 7/12, 7/18: Probable – T
23. Northern Parula 6/4 and 7/18 2 areas along River Trail heard: Probable – T
24. Common Yellowthroat pair calling to each other 6/13 and observed on several occasions: Probable – T and P
25. Eastern Towhee fledgling observed at end of River Trail 7/12: Confirmed – FL
26. Swamp Sparrow heard in suitable habitat: Possible – X
27. Northern Cardinal young calling 6/13 end of River Trail: Confirmed – FL + nesting 7/18 Kenilworth Park meadow area near my point count: Confirmed - NY
28. Indigo Bunting pair observed 5/29, pair singing to each other 6/4: Probable – P + T
29. Red-winged Blackbird mobbing crow 6/19: Probable – T + 7/12 young observed: Confirmed – FL
30. Brown-headed Cowbird 7/12 fed by ORORO, 6/20 fed by BGGN: Confirmed – FL
31. Orchard Oriole adult carrying food, 7/12 feeding BHCO chick, 7/18 with fledgling: Confirmed – FY + FL

Key:

POSSIBLE
X – Species heard or seen in breeding habitat within Safe Dates

PROBABLE

A- Agitated behavior or anxiety calls from adult. Parent birds respond to threats with distress calls or by attacking intruders.
P – Pair observed in suitable habitat within Safe Dates
T- Territorial behavior or singing male present at same location on at least 2 different days (observations separated by at least 5 days). Territoriality can be presumed from defensive encounters between individuals of the same species, or by observing a male singing from a variety of perches within a small area.
C- Courtship or copulation observed. This includes displays, courtship feeding, and birds mating.

CONFIRMED

NB – Nest building (except wrens and woodpeckers) or adult carrying nesting material.
FL – Recently fledged young or downy young. This includes dependent young only. Young cowbirds begging for food confirm both the cowbird and the host species.
FY – Adult carrying food for young.
ON – Occupied nest presumed by activity of parents: entering nest hole and staying, parents exchanging incubation responsibility, etc.
NY – Nest with young seen or heard. A cowbird chick in nest confirms cowbird and the host species.

Table 6

Kingman/Kenilworth Birds December 2001-November 2002

		Occurences		Total counted			Season				First observed	2002
Common Name	**Occurences**	**Kingman**	**Kenilworth**	**Kingman**	**Kenilworth**	**Max #**	**Sp**	**Su**	**F**	**W**	**Kingman**	**Kenilworth**
Grebe												
Pied-billed Grebe	1	0	1	0	1	1	0	0	1	0	----	11/7
Cormorant												
Double-crested Cormorant	41	27	14	49	18	4	16	2	23	0	4/2	4/2
Herons & Egret												
Great Blue Heron	239	162	77	278	107						1/3	1/9
Great Egret	81	56	25	135	50						5/29	4/8
Little Blue Heron	1	0	1	0	1	1	1	0	0	0	----	4/16
Green Heron	12	3	9	3	10	2	4	8	0	0	4/30	5/6
Black-crowned Night-Heron	1	1	0	1	0	1	0	1	0	0	6/28	-----
Vultures												
Black Vulture	4	2	2	2	3	2	3	0	0	0	4/2	4/30
Turkey Vulture	37	12	25	20	46						1/25	2/15
Ducks & Geese												
Snow Goose hybrid	3	3	0	3	0	1	1	0	0	2	1/25	-----
Canada Goose				10489	1845						1/3	1/3
Wood Duck	32	9	23	15	70						3/28	3/28
American Black Duck	27	3	24	4	97						1/9	1/9
Mallard				1057	823						1/3	1/3
Blue-winged Teal	1	1	0	2	0	2	1	0	0	0	4/23	-----
Northern Pintail	2	0	2	0	9	6	0	0	0	2	-----	1/18
American Green-winged Teal	12	6	6	69	28	20	6	0	2	4	3/28	1/18
Hooded Merganser	6	5	1	9	9	4	4	0	0	2	1/25	3/11
Common Merganser	2	1	1	1	1	1	1	0	1	0	11/26	4/16
domestic white duck	16	15	1	15	1	1	7	2	5	2	3/28	10/15
domestic (farm) goose	1	1	0	1	0	1	0	1	0	0	7/3	-----

* Second Maryland/DC Breeding Bird Atlas Project Handbook Maryland Ornithological Society

Table 6

Kingman/Kenilworth Birds December 2001-November 2002

		Occurences		Total counted			Season				First observed 2002	
Common Name	**Occurences**	**Kingman**	**Kenilworth**	**Kingman**	**Kenilworth**	**Max #**	**Sp**	**Su**	**F**	**W**	**Kingman**	**Kenilworth**
Hawks												
Osprey	60	20	40	23	48	4	26	28	6	0	4/8	4/2
Bald Eagle	14	9	5	11	7	3	4	0	6	4	1/25	1/25
Northern Harrier	2	2	0	2	0	1	0	0	2	0	10/15	-----
Sharp-shinned Hawk	4	4	0	4	0	1	0	0	3	1	10/15	-----
Cooper's Hawk	8	4	4	4	4	1	1	1	5	1	2/15	8/26
Red-shouldered Hawk	95	33	62	38	73						1/3	1/9
Red-tailed Hawk	9	5	4	6	5	2	0	0	9	1	10/24	9/3
American Kestrel	6	2	4	2	5	2	1	1	2	2	8/26	4/30
Peregrine Falcon	2	1	1	1	1	1	0	1	1	0	7/18	9/3
Quail												
Northern Bobwhite	3	0	3	0	3	1	2	1	0	0	-----	5/29
Plovers												
Semipalmated Plover	3	3	0	5	0	3	1	2	0	0	5/21	-----
Killdeer	168	58	52	354	243						1/3	1/3
Sandpipers												
Greater Yellowlegs	36	20	16	51	24						4/23	4/16
Lesser Yellowlegs	10	10	0	26	0	6	2	1	7	0	4/2	-----
Solitary Sandpiper	17	10	7	33	8	11	7	7	3	0	4/30	5/6
Spotted Sandpiper	22	16	6	40	9	15	11	9	2	0	4/30	5/21
Semipalmated Sandpiper	6	6	0	17	0	15	1	4	1	0	5/21	-----
Western Sandpiper	1	1	0	1	0	2	0	0	1	0	9/16	-----
Least Sandpiper	7	5	2	50	10	30	3	2	2	0	5/21	5/21
White-rumped Sandpiper	2	2	0	3	0	3	0	1	0	0	8/8	-----
Pectoral Sandpiper	3	3	0	10	0	6	0	0	3	0	8/14	-----
Dunlin	1	0	1	0	3	3	0	0	1	0	-----	10/31
Common Snipe	8	7	1	71	1	23	7	0	0	1	1/25	4/16

Table 6

Kingman/Kenilworth Birds December 2001-November 2002

		Occurences		Total counted			Season				First observed	2002
Common Name	**Occurences**	**Kingman**	**Kenilworth**	**Kingman**	**Kenilworth**	**Max #**	**Sp**	**Su**	**F**	**W**	**Kingman**	**Kenilworth**
Grebe												
Pied-billed Grebe	1	0	1	0	1	1	0	0	1	0	----	11/7
Ring-billed Gull				1373	756						1/3	1/3
Herring Gull	15	11	4	21	4	5	3	0	4	8	1/25	1/9
Lesser Black-backed Gull	2	2	0	3	0	2	1	1	0	0	2/1	-----
Great Black-backed Gull	25	19	6	34	12	5	7	0	4	13	1/18	1/18
Caspian Tern	3	1	2	1	2	1	3	0	0	0	4/2	4/2
Forster's Tern	1	0	1	0	1	1	0	1	0	0	-----	8/23
Doves												
Rock Dove	14	11	3	34	4	19	3	8	2	1	5/21	2/21
Mourning Dove	28	21	7	31	9	4	2	12	12	2	1/9	5/29
Cuckoo												
Yellow-billed Cuckoo	8	2	6	4	6	3	2	4	2	0	8/8	5/15
Swift												
Chimney Swift	139	79	60	437	400						4/23	4/16
Hummingbird & Kingfisher												
Ruby-throated Hummingbird	4	2	2	3	3	2	0	1	3	0	8/1	9/3
Belted Kingfisher	58	18	40	18	41						1/25	1/3
Woodpeckers												
Red-bellied Woodpecker	81	19	62	21	74						1/3	1/9
Yellow-bellied Sapsucker	4	0	4	0	4	1	0	0	2	2	-----	2/15
Downy Woodpecker	134	46	88	55	114						1/3	1/3
Hairy Woodpecker	14	1	13	2	12	2	2	4	4	4	2/1	1/9
Northern (Yellow-shafted) Flicker	78	32	46	34	66						1/3	1/3
Pileated Woodpecker	7	2	5	2	5	1	2	1	2	2	4/2	1/25

Table 6

Kingman/Kenilworth Birds December 2001-November 2002

		Occurences		Total counted			Season				First observed	2002
Common Name	**Occurences**	**Kingman**	**Kenilworth**	**Kingman**	**Kenilworth**	**Max #**	**Sp**	**Su**	**F**	**W**	**Kingman**	**Kenilworth**
Flycatchers												
Eastern Wood-Pewee	5	3	2	4	2	2	0	0	5	0	9/3	9/3
Acadian Flycatcher	2	0	2	0	2	1	1	1	0	0	-----	5/21
Willow Flycatcher	10	1	9	1	9	1	1	9	0	0	5/21	6/4
Least Flycatcher	1	0	1	0	1	1	1	0	0	0	-----	5/21
Eastern Phoebe	47	19	28	19	35	2	14	20	13		3/28	4/2
Great Crested Flycatcher	10	4	6	4	6	1	2	8	0	0	6/13	5/6
Eastern Kingbird	47	26	21	41	23	4	18	29	0	0	5/15	4/30
Vireos												
White-eyed Vireo	17	7	10	7	11	2	10	6	1	0	4/30	5/21
Warblilng Vireo	37	10	27	10	35	3	14	22	1	0	4/30	4/30
Philadelphia Vireo	1	0	1	0	1	1	0	0	1	0	------	9/24
Red-eyed Vireo	27	6	21	6	23	2	8	15	4	0	5/21	5/6
Jays & Crows												
Blue Jay	24	6	18	7	23	3	4	3	7	10	3/1	1/9
Crow sp.	328	181	147	637	1167	116	97	52	42	137	1/3	1/3
American Crow	255	92	164	242	526	65	54	65	49	87	1/3	1/3
Fish Crow	245	151	94	590	225	51	60	68	45	72	1/3	1/3
Lark and Swallows												
Horned Lark	2	1	1	7	3	7	0	0	1	0	11/20	11/20
Purple Martin	4	4	0	5	0	2	1	3	0	0	5/29	-----
Tree Swallow	64	25	39	47	84	13	45	18	1	0	3/28	3/28
Northern Rough-winged Swallow	72	42	30	100	91	15	43	27	2	0	4/23	4/23
Barn Swallow	100	49	50	135	142	33	36	63	0	0	4/23	4/16

Table 6

Kingman/Kenilworth Birds December 2001-November 2002

		Occurences		Total counted			Season				First observed	2002
Common Name	**Occurences**	**Kingman**	**Kenilworth**	**Kingman**	**Kenilworth**	**Max #**	**Sp**	**Su**	**F**	**W**	**Kingman**	**Kenilworth**
Chickadee, Titmouse, Nuthatch & Creeper												
Carolina Chickadee	201	74	127	96	234	7	62	67	27	45	1/3	1/3
Tufted Titmouse	76	12	63	14	91	6	20	14	18	23	2/1	1/3
White-breasted Nuthatch	6	0	6	0	6	1	1	0	0	5	-----	1/3
Brown Creeper	3	0	3	0	3	1	2	0	0	1	-----	1/25
Wrens												
Carolina Wren	283	128	155	166	262	8	73	85	83	42	1/3	1/3
House Wren	18	15	3	15	4	2	4	11	3	0	5/21	4/30
Winter Wren	10	2	8	3	11	3	1	0	9	0	11/14	3/1
Marsh Wren	9	7	2	10	2	2	1	8	0	0	6/13	5/29
Kinglets & Gnatcatcher												
Golden-crowned Kinglet	6	0	6	0	6	1	1	0	3	2	-----	1/18
Ruby-crowned Kinglet	42	14	28	27	38	5	5	0	26	11	1/25	1/3
Blue-gray Gnatcatcher	79	16	63	20	89	3	29	48	2	0	4/30	4/8
Thrushes												
Eastern Bluebird	28	18	10	47	21	8	8	6	7	7	1/3	1/3
Gray-cheeked Thrush	1	1	0	1	0	1	1	0	0	0	5/21	-----
Swainson's Thrush	4	2	2	2	2	1	1	0	3	0	9/16	5/21
Hermit Thrush	13	1	12	1	17	2	1	0	10	2	11/14	4/16
Wood Thrush	1	0	1	0	1	1	1	0	0	0	-----	5/6
American Robin	70	15	55	33	312	40	1	35	32	2	6/19	1/9
Mimids												
Gray Catbird	100	38	62	43	97	5	14	35	39	12	1/18	1/9
Northern Mockingbird	103	68	35	104	51		5	20	52	26	1/3	1/3
Brown Thrasher	6	2	4	2	4	1	1	4	1	0	6/13	4/2

Table 6

Kingman/Kenilworth Birds December 2001-November 2002

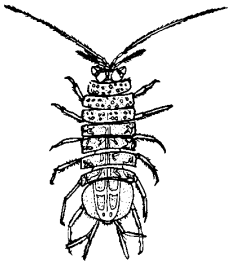
		Occurences		Total counted			Season				First observed	2002
Common Name	**Occurences**	**Kingman**	**Kenilworth**	**Kingman**	**Kenilworth**	**Max #**	**Sp**	**Su**	**F**	**W**	**Kingman**	**Kenilworth**
Starling, Pipit, & Waxwing												
European Starling	164	125	39	1766	466	179	50	63	40	11	1/3	4/16
American Pipit	5	3	2	6	2	3	0	0	5	0	11/7	11/7
Cedar Waxwing	26	12	14	472	181	200	9	10	6	1	5/21	5/21
Wood Warblers												
Nashville Warbler	1	0	1	0	1	1	0	0	1	0	-----	9/24
Northern Parula	5	0	5	0	5	1	2	2	1	0	-----	5/6
Yellow Warbler	18	14	4	18	11	4	12	6	0	0	4/30	5/6
Magnolia Warbler	2	0	2	0	2	1	0	0	2	0	-----	9/3
Black-throated Blue Warbler	3	0	3	0	4	2	1	0	2	0	-----	9/9
Yellow-rumped (Myrtle) Warbler	35	8	27	10	83	20	12	0	20	3	4/30	3/1
Black-throated Green Warbler	1	0	1	0	2	2	0	0	1	0	-----	9/24
Blackburnian Warbler	1	0	1	0	1	1	0	0	1	0	-----	9/24
Prairie Warbler	1	0	1	0	1	1	1	0	0	0	-----	4/30
Palm Warbler	9	4	5	7	6	4	3	0	6	0	9/24	4/8
Bay-breasted Warbler	1	1	0	1	0	1	1	0	0	0	5/21	-----
Blackpoll Warbler	10	8	2	12	2	4	9	0	1	0	5/21	5/15
Black-and-white Warbler	1	0	1	0	1	1	0	0	1	0	-----	9/16
American Redstart	4	1	3	1	3	1	3	1	0	0	5/21	5/21
Prothonotary Warbler	1	0	1	0	1	1	1	0	0	0	-----	5/6
Northern Waterthrush	6	5	1	8	1	3	5	0	1	0	5/21	9/16
Louisiana Waterthrush	1	0	1	0	1	1	0	1	0	0	-----	8/23
Kentucky Warbler	1	0	1	0	1	1	1	0	0	0	-----	5/6
Common Yellowthroat	43	12	31	12	40	2	14	26	3	0	4/30	4/16
Tanager												
Scarlet Tanager	1	0	1	0	1	1	0	0	1	0	-----	9/24

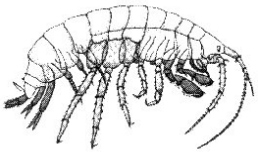
Kingman/Kenilworth Birds December 2001-November 2002

		Occurences		Total counted			Season				First observed	2002
Common Name	**Occurences**	**Kingman**	**Kenilworth**	**Kingman**	**Kenilworth**	**Max #**	**Sp**	**Su**	**F**	**W**	**Kingman**	**Kenilworth**
Sparrows												
Eastern Towhee	4	1	3	1	5	2	2	2	0	0	6/28	4/16
Field Sparrow	12	9	3	18	10	8	4	0	8	0	4/8	4/16
Savannah Sparrow	1	1	0	1	0	1	1	0	0	0	4/2	-----
Fox Sparrow	21	12	9	31	22	9	5	0	5	11	1/3	2/15
Song Sparrow	353	211	142	826	269	19	89	88	96	80	1/3	1/3
Swamp Sparrow	30	13	17	25	24	5	2	1	22	5	1/25	1/3
White-throated Sparrow	132	65	67	231	340	41	30	0	52	50	1/3	1/3
White-crowned Sparrow	1	1	0	1	0	1	0	0	1	0	11/7	-----
Dark-eyed Junco	6	4	2	7	3	3	0	0	6	0	10/24	11/14
Cardinal, Grosbeaks, Bunting												
Northern Cardinal	317	153	164	265	332	9	86	112	77	42	1/3	1/9
Rose-breasted Grosbeak	1	0	1	0	1	1	1	0	0	0	-----	4/30
Blue Grosbeak	12	7	5	8	5	2	4	8	0	0	5/29	4/30
Indigo Bunting	72	30	42	42	60	4	10	57	5	0	5/15	4/30
Blackbirds & Orioles												
Bobolink	1	1	0	1	0	1	0	0	1	0	9/3	----
Red-winged Blackbird	223	191	132	434	921	125	79	88	35	21	1/3	1/9
Rusty Blackbird	3	0	3	0	7	4	1	0	2	0	----	4/8
Common Grackle	88	45	43	80	83	7	30	52	6	0	4/23	4/8
Brown-headed Cowbird	14	12	2	18	2	5	5	9	0	0	4/30	6/20
Orchard Oriole	15	4	11	5	17	2	3	11	1	0	4/30	4/30
Baltimore Oriole	10	5	5	5	7	2	2	7	1	0	5/29	6/4
Winter Finches												
House Finch	69	51	18	305	65	31	5	15	28	21	1/3	5/21
American Goldfinch	166	96	70	205	95	10	29	76	41	20	1/3	1/9
Weaver Finch												
House Sparrow	8	7	1	15	1	6	1	7	0	0	4/30	7/12

Part 3- Benthic Macroinvertebrates

First Year Annual Report (2002) for the Benthic Macroinvertebrate Populations of Urban Freshwater Tidal Wetlands in the Anacostia River, Washington, D.C.





Kevin D. Brittingham
Dick Hammerschlag

Abstract:

Considerable work has been conducted on the benthic populations of such aquatic systems as streams and lakes, but there remains a paucity of effort on tidal wetlands, especially freshwater. This study will characterize the benthic communities establishing themselves on recently reconstructed urban freshwater tidal wetlands in Washington, D.C. in comparison to a similar relic wetland in the Anacostia as well as to a reference wetland in the adjacent Patuxent River watershed. The focus of the study will be the two main areas of Kingman Marsh, which were reconstructed from Anacostia, dredge material by the U.S. Army Corps of Engineers in 2000. Populations from this 'new' marsh will be compared to those of similarly reconstructed Kenilworth Marsh (1993) just one half a mile upstream, as well as to the relic Dueling Creek Marsh in the Anacostia and the outside reference Patuxent Marsh in an adjacent watershed. Benthic organisms will be collected using selected techniques including the Ekman bottom grab sampler, sediment corer, D-net and Hester-Dendy sampler. Samples will be collected at least seasonally from tidal guts (channel); tidal mud flats; three vegetation/sediment zones = low, middle and high marsh; and pools. Collected samples will be preserved in the field and counted in the laboratory.

Background and Justification:

The U.S. Army Corps of Engineers (COE) has been the lead agency in the effort to reconstruct and restore freshwater tidal wetlands along the Anacostia River in Washington, D.C. This large-scale effort involving millions of dollars of effort justifies a rigorous monitoring program to evaluate the level of success in recreating the wetlands and their habitat. The areas in question had once been vital freshwater tidal wetlands but had been mandatorily removed by the COE during the first half of the 20th century. Recently, the COE has used various program components to justify rebuilding some of the lost wetlands using dredge material available from the heavily sedimented Anacostia channel. The wetland areas involved are located in the District of Columbia on National Park Service lands.

The monitoring work should be designed not just to determine whether the COE achieved what they set out to do but to learn from the procedures involved what worked well and what could be improved for the next project. USGS PWRC has been a lead player documenting the pre-and post-reconstruction status of urban freshwater tidal wetlands in the Anacostia River, Washington, D.C. This project will be conducted in response to requests by the District of Columbia Department of Environmental Health (D.C.), Baltimore District of the Corps of Engineers and the National Capital Region of the National Park Service (NPS). These agencies wish to tap the expertise and interests residing at PWRC to conduct a detailed benthic study covering the Anacostia wetlands. Collected data is to be analyzed and used to support required monitoring and project baseline studies for the numerous wetland reconstruction projects in the Anacostia being implemented by COE. The high cost, high visibility and challenging circumstances for successful freshwater tidal wetland reconstruction in urbanized Washington, D.C. justify multi-year monitoring to measure the level of marsh reconstruction success. Using

benthic taxa and population level as a short-term indicator given that most members of the benthic macroinvertebrate community have relatively short life cycles, we expect to evaluate rapidly whether and to what extent the urban reconstructed wetlands are evolving toward reference wetlands, providing suitable habitat and whether there are pollution effects. It should be re-emphasized that literature review has revealed a paucity of information pertaining to the invertebrate communities of freshwater tidal wetlands. There are special challenges in pursuing this work due to the play of tidal cycles and fluxes determining varying inundation periods for marsh zones. The benthic communities may well respond to the tidal regimes as they can to periods of flooding. We will attempt to characterize the benthic populations in as many of the resulting marsh zones (habitat areas) as proves useful and viable. A measure of adaptive sampling will be involved. Nonetheless the characterization of these benthic communities especially relying on metrics such as abundance, taxonomic richness and pollution tolerance will provide a practical bioassessment. These determinations will be compared to other indicators to further validate the usefulness of the benthos as short- term indicators of reconstructed wetland health. Such information will be scientifically important as a progress yardstick for the reconstructed Anacostia wetlands and others like them. This study will also utilize information from others involving the marshes in question concerning such parameters as vegetation, hydrology, sedimentation processes, soil structure and soil properties. Since the Anacostia is watershed to the Chesapeake Bay, this study will be contributing to the base of information used to better understand the ecology of the Chesapeake Bay system.

Objectives:

While the overall objective of this study must be to meet the client needs of evaluating the relative success of urban freshwater tidal marsh reconstruction, there are number of task oriented goals that will also be pursued. The hypothesis is that the benthic community can provide a viable bioassessment of the urban freshwater tidal reconstructed habitat; or, more statistically representative as a null hypothesis - the benthic community will not suffice as an indicator of successful wetland reconstruction. Project tasks will include:

1. Identifying to the extent practical the benthic organisms inhabiting the Anacostia marshes (Kingman, Kenilworth and Dueling Creek) as well as the selected Patuxent Marsh area.
2. Determining whether time of marsh establishment (age) relates to differing benthic communities by evaluating as a series: Kingman Marsh as reconstructed in 2000, Kenilworth Marsh as reconstructed in 1993, Dueling Creek as a disturbed but last remaining relic marsh area in the Anacostia, and a relatively undisturbed Patuxent marsh area in an outside but adjacent watershed.
3. Evaluating the influence of marsh (sediment) elevations (elevation gradient effect) and tidal regimes on benthic community composition in the freshwater tidal system by sampling channel; mud flats (exposed at low tide); low, mid and high marsh zones; and stable but temporary pools.

4. Using combinations of quantifiable methods of sampling such as the Ekman dredge and corers coupled with qualitative benthic sampling devices such as sweeps with D nets and placement of Hester-Dendy samplers over periods of time.
5. Comparing the benthic populations of the reconstructed marshes (Kingman and Kenilworth) with the non-reconstructed marsh areas of Dueling Creek and Patuxent.
6. Evaluating the various wetland benthic communities for pollution tolerance.
7. Comparing the results from this study with those from similar wetland projects as may be reported in the literature.
8. Providing annual and final reports to the Baltimore Corps of Engineers and the District of Columbia. The study is well structured to produce peer-reviewed publications in professional journals as well as presentations at scientific meetings.

Year 1 activities:

The study proposal went through peer review at the Patuxent Wildlife Research Center with minimal recommended adjustments to the study. The detailed sampling schedule as well as the methods for sampling and objectives for the study can be seen in the project proposal.

Preliminary sampling started in September of 2001 to determine the effectiveness of the sampling gear and identify possible sampling sites. As a result, six habitat units (channel, mudflat, low marsh, middle marsh, high marsh, and pools) were selected to be sampled in the four freshwater tidal wetlands (Patuxent, Dueling Creek, Kenilworth, and Kingman).

Sampling for 2002 began on January 25 and ended on December 2, 2002. There were nearly 500 samples collected from the four wetlands. A full suite of samples (15 per site x 6 sites = 90 samples) required about four days of effort to collect for each time period. Processing and identification of each sample requires over a full hour to identify invertebrates present, with some samples containing over 500 organisms. Validation of correct identifications has been pursued through a network of biologists who are current members of the North American Benthological Society.

All of the 2002 hester-dendy (HD) samples have been processed and identified, which represents some 81,000 organisms. The HD samplers are used for the pools and channels that are inundated most of the time. Nearly sixty taxonomic units are present in the HD collection, with more pending validation. Preliminary findings show certain organisms such as Chironomids (aquatic fly larvae) to have densities close to 4,000 per meter squared (m^2). Densities are calculated by taking the actual number of organisms found in a sample and multiplying it by the conversion factor for meter squared. Oligochaetes (aquatic worms) are second in abundance with densities near 2,000 per m^2. Amphipod and Isopod densities are close to 1,000 per m^2. Data from the HD samplers is shown in Table 1 (Table 1a = pool HD; Table 1b = channel HD).

Over 50% of the Ekman and dip net samples for 2002 have been processed, however the data has not been entered into spreadsheet format. Although not all the samples have been identified, some interesting findings are emerging. Mudflat samples have low diversity but very high abundance, with some samples having densities of chironomids and oligochaetes ranging from 5,000 to 12,000 per m^2. Vegetated zones

have a greater diversity than mudflats and channels, however pool habitats are showing the greatest diversity.

More effort is needed to establish the selected elevations for the vegetation zones (mudflat; low, middle, and high marsh) at the four wetlands, which is an ongoing operation. Hopefully, with the aid of additional benchmarks, this process will become easier. The outlook for 2003 is promising, however the long cold winter has set back the winter sampling and elevation work. There are plans to attend the Mid-Atlantic Biology Workshop in Berkeley Springs, WV for a freshwater mussel workgroup for help in identification of Spharid mussels. Also, an abstract was submitted and accepted to the North American Benthological Society 51st Annual Meeting in Athens, GA; however funding may not be available to support travel to the meeting.

Table 1a.Kingman POOL Hester-Dendy Sampler

	F01	W02	SP02	SU02	SU02	F02	W02	SP02	SU02	F02		
Taxa	KG1P	KG1P	KG1P	KG1P	KG1P	KG1P	KG2P	KG2P	KG2P	KG2P	TOTAL	Total/m^2
Beezia/palpomia											0	0
chironomid	5	3	98	5	7	13	13	370	436	356	1306	13060
Dolichopodidae											0	0
Psychodidae											0	0
Stratiomydae											0	0
tipulidae											0	0
tabanidae											0	0
Zavrelimyia											0	0
unkwn snail											0	0
Limpet									4		4	40
Lymnaeidae											0	0
physidae	8	3	12				1				24	240
planorbidae	1		1	1		1			27	4	35	350
vivipardae											0	0
libellulidae/corduliidae	1	1									2	20
Ischnura	3							1			4	40
Gammarus	2		18					13	11	3	47	470
Asellus											0	0
Cyrnellus						6			6	11	23	230
collembola	1										1	10
unkwn beetle											0	0
Berosus											0	0
dytiscidae											0	0
Lampyridae											0	0
Mesovelia											0	0
Corbicula	2										2	20
spharid		1	4						2		7	70
oligochaete	54	35	60	25	8	141	117	2	42	6	490	4900
nematoda									2		2	20
turbellarian											0	0
Desserobdella phalera			1								1	10
Erpobdella punctata											0	0
Gloiobdella elongata											0	0
Helobdella fusca											0	0
Helobdella stragnalis											0	0
Mooreobdella microstoma		9									9	90
unkwn leech											0	0
Placobdella sp?											0	0
TOTAL organisms	77	52	194	31	15	161	131	386	530	380	1957	19570
TOTAL/m^2	770	520	1940	310	150	1610	1310	3860	5300	3800		

Table 1a. Kenilworth POOL Hester-Dendy Sampler

	W02	SP02	SU02	F02	W02	SP02	SU02	SU02	F02		
Taxa	KW1P	KW1P	KW1P	KW1P	KW2P	KW2P	KW2P	KW2P	KW2P	TOTAL	Total/m^2
Beezia/palpomia	1					1				2	20
chironomid	10	4	4	31	1	27	9	24	27	137	1370
Dolichopodidae		3								3	30
Psychodidae										0	0
Stratiomydae			1							1	10
tipulidae										0	0
tabanidae										0	0
Zavrelimyia										0	0
unkwn snail										0	0
Limpet										0	0
Lymnaeidae										0	0
physidae					2		13		4	19	190
planorbidae						1				1	10
vivipardae										0	0
libellulidae/corduliidae										0	0
Ischnura										0	0
Gammarus					19				12	31	310
Asellus	3	3			44				9	59	590
Cyrnellus										0	0
collembola										0	0
unkwn beetle		2								2	20
Berosus										0	0
dytiscidae										0	0
Lampyridae										0	0
Mesovelia						4				4	40
Corbicula										0	0
spharid				9	1	7	4	4	3	28	280
oligochaete	21	25	2	79	4	83	8	21	49	292	2920
nematoda										0	0
turbellarian										0	0
Desserobdella phalera					2				1	3	30
Erpobdella punctata				1						1	10
Gloiobdella elongata										0	0
Helobdella fusca										0	0
Helobdella stragnalis						2	3		1	6	60
Mooreobdella microstoma										0	0
unkwn leech										0	0
Placobdella sp?										0	0
TOTAL organisms	35	37	7	120	73	125	37	49	106	589	5890
TOTAL/m^2	350	370	70	1200	730	1250	370	490	1060		

Table 1a. Dueling and Patuxent POOL Hester-Dendy Sampler

	W02	SP02	SU02	F02	F01	W02	SP02	F02		
Taxa	PAXP	PAXP	PAXP	PAXP	DCP	DCP	DCP	DCP	TOTAL	Total/m^2
Beezia/palpomia						3	2		5	50
chironomid	2		14	1		6	3	26	52	520
Dolichopodidae							3	1	4	40
Psychodidae							2		2	20
Stratiomydae		3							3	30
tipulidae						1			1	10
tabanidae					1				1	10
Zavrelimyia									0	0
unkwn snail		2					2		4	40
Limpet									0	0
Lymnaeidae		2							2	20
physidae				1	12	4		1	18	180
planorbidae									0	0
vivipardae									0	0
libellulidae/corduliidae									0	0
Ischnura	3								3	30
Gammarus									0	0
Asellus			1						1	10
Cyrnellus									0	0
collembola						60	32	21	113	1130
unkwn beetle									0	0
Berosus									0	0
dytiscidae									0	0
Lampyridae		1							1	10
Mesovelia									0	0
Corbicula									0	0
spharid		64	15		12	1	9		101	1010
oligochaete				4	97	8	8	34	151	1510
nematoda				1		8		6	15	150
turbellarian							15		15	150
Desserobdella phalera									0	0
Erpobdella punctata							1		1	10
Gloiobdella elongata							11		11	110
Helobdella fusca									0	0
Helobdella stragnalis									0	0
Mooreobdella microstoma									0	0
unkwn leech									0	0
Placobdella sp?									0	0
TOTAL organisms	5	72	30	7	122	91	88	89	504	5040
TOTAL/m^2	50	720	300	70	1220	910	880	890		

Table 1b.
KingmanCHANNEL
Hester-Dendy
Sampler

	F01	W02	SP02	SU02	SU02	F02	W02	SP02	SU02	F02		
Taxa	KG1TG	KG1TG	KG1TG	KG1TG	KG1TG	KG1TG	KG2TG	KG2TG	KG2TG	KG2TG	TOTAL	Total/m^2
Beezia/palpomia											0	0
chironomid	48	45	103	151	66	185	166	26	210	230	1230	12300
Dolichopodidae											0	0
Psychodidae											0	0
Stratiomydae											0	0
tipulidae											0	0
tabanidae											0	0
Zavrelimyia									1		1	10
unkwn snail											0	0
Limpet											0	0
Lymnaeidae											0	0
physidae		1	1		1	1	3			3	10	100
planorbidae						1	1	3	3	18	26	260
vivipardae			1								1	10
libellulidae/corduliidae											0	0
Ischnura		1									1	10
Gammarus	20	39	107		4	6	40	1	3		220	2200
Asellus											0	0
Cyrnellus						2			24	54	80	800
collembola											0	0
unkwn beetle											0	0
Berosus											0	0
dytiscidae											0	0
Lampyridae											0	0
Mesovelia											0	0
Corbicula				1							1	10
spharid	5	1		4	3						13	130
oligochaete	82	10	21	31	94	9	32	62	5	5	351	3510
nematoda					1						1	10
turbellarian										7	7	70
Desserobdella phalera	2		1	3	3		3	2			14	140
Erpobdella punctata					1						1	10
Gloiobdella elongata											0	0
Helobdella fusca											0	0
Helobdella stragnalis											0	0
Mooreobdella microstoma											0	0
unkwn leech		1						1			2	20
Placobdella sp?											0	0
TOTAL organisms	157	98	234	190	173	204	245	95	246	317	1959	19590
TOTAL/m^2	1570	980	2340	1900	1730	2040	2450	950	2460	3170		

Table 1b. Kenilworth CHANNEL Hester-Dendy Sampler

	W02	SP02	SU02	F02	F01	W02	SP02	SU02	SU02	F02		
Taxa	KW1TG	KW1TG	KW1TG	KW1TG	KW2TG	KW2TG	KW2TG	KW2TG	KW2TG	KW2TG	TOTAL	Total/m^2
Beezia/palpomia	2										2	20
chironomid	11	43	92	47		1	4	4	2	28	232	2320
Dolichopodidae											0	0
Psychodidae											0	0
Stratiomydae											0	0
tipulidae											0	0
tabanidae											0	0
Zavrelimyia											0	0
unkwn snail											0	0
Limpet											0	0
Lymnaeidae											0	0
physidae	38	2	4	19			4			2	69	690
planorbidae	1		6	8						4	19	190
vivipardae											0	0
libellulidae/corduliidae											0	0
Ischnura											0	0
Gammarus	34			42						28	104	1040
Asellus	96			1	6	19	8			1	131	1310
Cyrnellus				1						1	2	20
collembola			1				1	1			3	30
unkwn beetle											0	0
Berosus											0	0
dytiscidae											0	0
Lampyridae											0	0
Mesovelia											0	0
Corbicula											0	0
spharid	8	3			11	11	7	4	2	2	48	480
oligochaete	13	229	108	15	74	32	67	85	16	18	657	6570
nematoda	4						1		1		6	60
turbellarian											0	0
Desserobdella phalera	3	1	4							1	9	90
Erpobdella punctata					1						1	10
Gloiobdella elongata								1			1	10
Helobdella fusca											0	0
Helobdella stragnalis										1	1	10
Mooreobdella microstoma											0	0
unkwn leech	13						1		1		15	150
Placobdella sp?					1						1	10
TOTAL organisms	223	278	215	133	93	63	93	95	22	86	1301	13010
TOTAL/m^2	2230	2780	2150	1330	930	630	930	950	220	860		

Table 1b. Dueling and Patuxent CHANNEL Hester-Dendy Sampler

	W01	W02	SP02	SU02	SU02	F02	F01	W02	SP02	SU02	SU02	F02		
Taxa	PXTG	PXTG	PXTG	PXTG	PXTG	PXTG	DCTG	DCTG	DCTG	DCTG	DCTG	DCTG	TOTAL	Total/m2
Beezia/palpomia													0	0
chironomid	3	1	73	26			5	2	14	62	51	53	286	2860
Dolichopodidae													0	0
Psychodidae													0	0
Stratiomydae													0	0
tipulidae													0	0
tabanidae													0	0
Zavrelimyia													0	0
unkwn snail				3									3	30
Limpet												1	1	10
Lymnaeidae													0	0
physidae		2	13		1	2		1	3			1	21	210
planorbidae	3	3	2	8		1			5	3	1	26	46	460
vivipardae			1										1	10
libellulidae/corduliidae								1					1	10
Ischnura	5						1						1	10
Gammarus	23		34	24	357	155	39	12	5	2		4	632	6320
Asellus	74	4	29	16	10			1					56	560
Cyrnellus													0	0
collembola	1												0	0
unkwn beetle													0	0
Berosus		1											0	0
dytiscidae			1										1	10
Lampyridae													0	0
Mesovelia													0	0
Corbicula													0	0
spharid	7		9	1	1	3			1	3		1	19	190
oligochaete	28	3	4	31			12	7	6	6	131	22	219	2190
nematoda										1			1	10
turbellarian						3		2				3	8	80
Desserobdella phalera	1		3	4	1			4		2		2	16	160
Erpobdella punctata													0	0
Gloiobdella elongata													0	0
Helobdella fusca										2			2	20
Helobdella stragnalis	5		7	1	4								12	120
Mooreobdella microstoma													0	0
unkwn leech			21										21	210
Placobdella sp?													0	0
TOTAL organisms	150	14	197	114	374	164	57	30	34	81	183	113	1347	13470
TOTAL/m^2	1500	140	1970	1140	3740	1640	570	300	340	810	1830	1130		